"A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL"

Dissertation Submitted to

THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERSITY

Chennai

In partial fulfillment of the regulations for the award of the degree of

M.D. BRANCH – I (GENERAL MEDICINE)

DEPARTMENT OF GENERAL MEDICINE

STANLEY MEDICAL COLLEGE, CHENNAI

THE TAMIL NADU DR.M.G.R.MEDICAL UNIVERSITY TAMILNADU, INDIA

MAY 2019

CERTIFICATE

This is to certify that this dissertation entitled **A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL** submitted by Dr.YAMINI .M. to the faculty of General Medicine, The Tamil Nadu Dr.M.G.R Medical University, Tamilnadu, Chennai in partial fulfillment of the requirement for the award of M.D degree Branch I (General Medicine) is a bonafide research work carried out by him under my direct supervision and guidance.

GUIDE:

Prof.Dr.T.B.UMA DEVI., M.D.,
Chief Medical Unit-VI,
Department of Medicine,
Government Stanley Hospital,
Chennai1.

HOD:

Prof.Dr.R.MUTHUSELVAN M.D.,
Head of Department of Medicine
Stanley Medical College and Hospital
Chennai-1.

PROF. DR.S.PONNAMBALA NAMASIVAYAM, MD, DA, DNB

THE DEAN

STANLEY MEDICAL COLLEGE AND HOSPITAL,

CHENNAI-10.

DECLARATION

I, Dr.M.YAMINI solemnly declare that Dissertation title **A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL** is a bonafide work done by me at Government Stanley Hospital Chennai, during March 2018 to august 2018 under the guidance and supervision of Prof .Dr. T.B.UMADEVI M.D., Professor of Medicine, Government Stanley Hospital,, Chennai. I also declare that this bonafide work or a part of this work was not submitted by me or any other for award degree or diploma to any other university, board either in India or abroad.

This dissertation is submitted to the Tamilnadu DR. M.G.R Medical University, towards the partial fulfillment of requirement for the award of M.D. Degree (Branch – I) in General Medicine.

Place: Chennai
Date :

Signature of the candidate
(Dr. M. YAMINI)

GOVERNMENT STANLEY MEDICAL COLLEGE & HOSPITAL,CHENNAI_-01

INSTITUTIONAL ETHICS COMMITTEE

Title of the Work : A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THEOMBOLYSIS IN A TERTIARY CARE HOSPITAL.

Principal Investigator : Dr. Yamini

Designation : PG IN GEN MEDICINE

DEPARTMENT : DEPARTMENT OF GEN MEDICINE

Govt. Stanley Medical College.

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 17.02.2018 at the Council Hall, Stanley Medical College, Chennai-1 at 10am.

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

MEMBER SECRETARY,
IEC, SMC, CHENNAI

MEMBER SECRETARY
ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE
CHENNAI-600 001.

CERTIFICATE - II

This is to certify that this dissertation work titled **"A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL"** of the candidate **Dr. M. Yamini** with registration Number **201611065** for the award of **M.D. Branch – I (General Medicine)** personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows **14 percentage** of plagiarism in the dissertation.

Guide & Supervisor sign with Seal.

URKUND

Urkund Analysis Result

Analysed Document:	REVIEW OF LITERATURE 9th oct.doc (D42435063)
Submitted:	10/11/2018 6:14:00 PM
Submitted By:	dryaminibanugopan@gmail.com
Significance:	14 %

Sources included in the report:

REVIEW OF LITERATURE.docx (D42142612)
final upload.docx (D31273758)
rooa thesis plag check.docx (D31296175)
LAT-ORIGINAL final thesis.docx (D31193228)
https://emedicine.medscape.com/article/338385-overview
https://en.wikipedia.org/wiki/National_Institutes_of_Health_Stroke_Scale
https://www.slideshare.net/sunny_8162/2018-stroke-guidelines
https://docplayer.net/19545485-Despite-the-increase-in-the-global-burden-of-stroke-advances.html
https://www.wikijournalclub.org/wiki/CHANCE
https://de.slideshare.net/YoselinSanchez1/stroke-manejo-aha-asa-2013

Instances where selected sources appear:

48

SPECIAL ACKNOWLEDGEMENT

I gratefully acknowledge and thank

PROF.DR.S.PONNAMBALA NAMASIVAYAM, MD, DA, DNB

DEAN

STANLEY MEDICAL COLLEGE AND HOSPITAL, CHENNAI.

For granting me permission to utilize the resources of this institution for my study

ACKNOWLEDGEMENT

I am extremely thankful to our beloved Superintendent**, Prof.Dr. DHANASEKARAN** Government Stanley Hospital Chennai-1, for having granted permission to do this dissertation in Government Stanley Hospital, Chennai.

I am very grateful to our Professor and Head of the Department of Medicine **Prof. & HOD Dr.R.MUTHUSELVAN M.D.,** for acceptance to do this dissertation.

I am extremely grateful to my unit chief **Dr.T.B. UMA DEVI.M.D., and Retd.Prof.Dr.K.NATARAJAN.,** who taught me the basic aspects and clinical skills in internal medicine which is an essential pre requisite for pursuing any dissertation work. The guidance and encouragement they provided need a special mention.

I am extremely grateful to **Prof.Dr.ARUNAN.M.D.D.M.** Department of Neuromedicine who granted permission to me to do this study in his department.

I am extremely thankful to our Registrar **Dr.R.NAMITHA NARAYANAN M.D.,** and our unit **Asst. Professors Dr.R.VIJAYANAND ,M.D., & Dr.S.LAKSHMI, M.D,** for their valuable suggestions, guidance and support I thank our patients who submitted themselves for this study without whom the study would not be possible.

I extend my love and gratitude to my family and friends for their immense help for this study.

Date: Signature of the Candidate

Place: Dr.M.YAMINI

TABLE OF CONTENTS

INTRODUCTION

Institution of intra-venous thrombolysis as treatment modality for acute ischemic stroke has revolutionalised the field of Neuromedicine in the past few years. The concept of thrombolysis and various endovascular interventions for acute stroke has opened the doors of the field of Interventional Neurology. The better availability of Neuro-imaging services has enhanced the decision making capacity for using acute thrombolysis.

Like myocardial infarction, acute ischemic stroke is equivalent to “Brain Attack”. It should be treated as acute emergency and top priority to be given during triage. Preventing the rapid loss of neurons due to ischemic insult, and preserving the ischemic penumbra from permanent damage is the corner stone of the thrombolytic therapy in AIS. Effective treatment with proper response is very important in prevention of complications and improving the quality of life of the patient.

AIMS AND OBJECTIVES

AIM OF THE STUDY

The aim of present study is to assess the clinical outcome and improvement in quality of life of patients undergoing intravenous thrombolysis for acute ischemic stroke in tertiary care center

PRIMARY OBJECTIVES

To study the clinical profile of patients undergoing thrombolysis for acute stroke presenting within window period (4.5hrs)

- To determine the age distribution of patients undergoing IV thrombolysis for acute ischemic stroke.
- To study the gender distrbution among the subjects.
- To determine the percentage of pateints presenting within the window period of 3 hrs and 3-4.5 hrs.
- Risk factor assessment in patients undergoing thrombolysis.
- To determine the percentage of patients presenting with high BP at the time of admission.
- To determine the percentage of patients who needs IV anti-hypertensive drugs before thrombolysis therapy.

- To determine the percentage of patients who present with high blood glucose level at the time of admission, and determinethe mean blood glucse level.
- To determine the mean NIHSS(National Institute of Health Stroke Scale) at the time of admission and after 24 hours.
- To determine the percentage of people with normal CT and early ischemic changes in CT at the time of admission.
- To find the mean ASPECT SCORE.
- To determine the percentage of patients having an ischemic change or hemorrhagic manifestation in CT taken 24 hours later.
- To determine the presence of Primary outcome (reduction in NIHSS by ≥ 4 points).
- To study the distribution of complications.
- To study the secondary outcome-Modified Rankin Score (mRS) of 0-2 at the end of 3 months after thrombolysis to assess the quality of life.

REVIEW OF LITERATURE

HISTORICAL PERSPECTIVE

Stroke is an ancient disease. Imhotep, Father of Egyptian medicine, described stroke around 3000 BC[1,2]. In 1600 Thomas Willis described Circle of Willis and used the term "Apoplexy". Modern era of stroke started when Miller Fisher described stroke and its features. In the last few years there was a tremendous change in management of stroke. Introduction of IV rt-PA in 1996 as proven effective treatment was a trend setter in the field of medicine. The dawn of the field of interventional neurology by using endovascular therapies is another milestone in treatment of stroke in recent time. An improvement in neuroimaging and diagnostic services is also of paramount importance in the development of field of neuromedicine.

TIME IS BRAIN

The average number of neurons in human cerebrum is 22 billion. When there is an ischemia, in a minute about 1.9 million neurons, 14 billion synapses, and 12 km length of myelinated fibers are lost[3]. With passing of each hour the ischemic brain ages 3.6 years more than normal. Prompt intervention is very essential for maintaining the neuronal cell mass by protecting them from the ischemic insult.

BLOOD SUPPLY OF BRAIN[4]

The entire blood supply of the brain and spinal cord depends on two sets of branches from the dorsal aorta. The vertebral arteries arise from the sub-clavian arteries, and the internal carotid arteries are branches of the common carotid arteries. The internal carotid arteries branch to form two major cerebral arteries, the anterior and middle cerebral arteries. The right and left vertebral arteries come together at the level of the pons on the ventral surface of the brainstem to form the midline basilar artery. The basilar artery joins the blood supply from the internal carotids in an arterial ring at the base of the brain called the circle of Willis. The posterior cerebral arteries arise at this confluence, as do two small bridging arteries, the anterior and posterior communicating arteries. Conjoining the two major sources of cerebral vascular supply via the circle of Willis presumably improves the chances of any region of the brain continuing to receive blood if one of the major arteries becomes occluded.

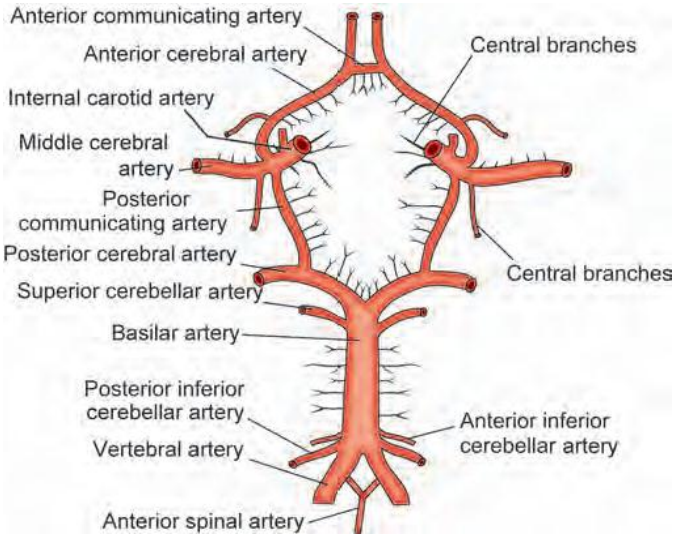


Figure-1 Blood supply of brain- The Circle of Willis.

CLASSIFICATION OF ISCHEMIC STROKE (TOAST CRITERIA)[5,6]:

- Large artery atherosclerosis.
- Cardio embolic stroke.
- Small vessel occlusion (lacunar).
- Stroke of undetermined origin.

ISCHEMIC PENUMBRA

The concept of ischemic penumbra[7] explains the capacity of hypo-perfused neurons to recover when the perfusion is improved. Hypo-perfusion is not enough to cause permanent damage. The area of ischemic penumbraregains function if the occluded vessels are re-canalized. Ischemic penumbra is a dynamic process, present even in the core of infarct for a short period of time before irreversible damage sets in (figure -2). Earlier the treatment salvage of more neural tissue is possible.

The main aim of thrombolysis is to salvage maximum number of neurons in the penumbra by earlier restoration of blood flow to the ischemic tissue and also minimizing the tissue reperfusion injury (figure -3).

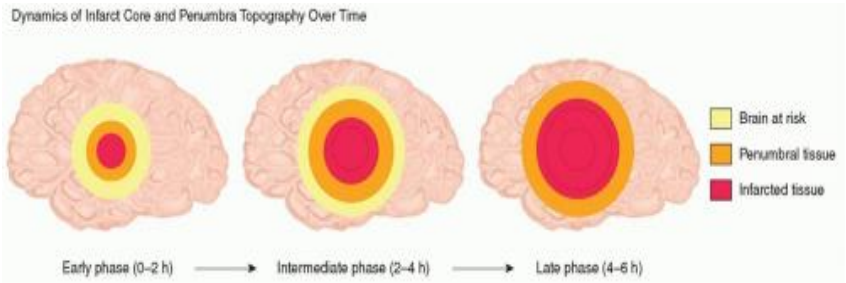


Figure-2 Concept of ischemic penumbra

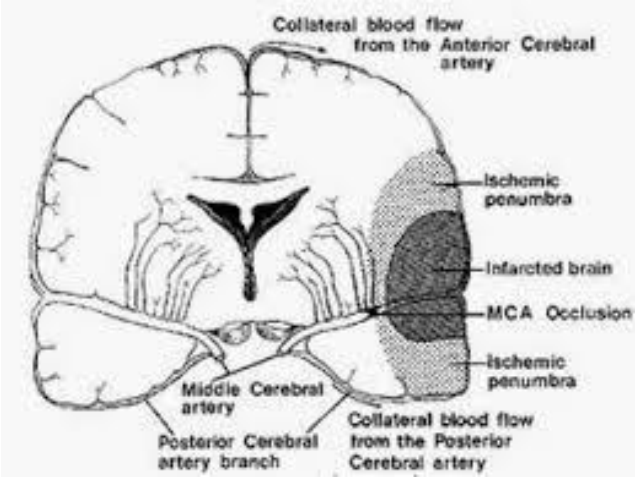


Figure-2 Concept of ischemic penumbra.

PREHOSPITAL MANAGEMENT

PUBLIC EDUCATION

The good functional outcome of early stroke management begins with recognition of stroke when it occurs. Many studies demonstrate that public education[8] about signs and symptoms of stroke improves recognition. The targets should be prospective patients, their family members and caregivers empowering them to call emergency services promptly. The FAST algorithm[9] (face, arm, speech, time) is the most commonly used message for campaign (figure-3). "ACT FAST" is the slogan used to educate emergency services and general public to know the benefits of reaching medical services earlier for better outcome. Distribution of flyers, posting banners at prominent places of public gatherings and conduction of classes comprise of methods of spreading the information. Introduction of the concept among school and college going youngsters may be useful method of educating large number of people at a same time[10,11].

Figure-4 ACT FAST algorithm.

STROKE CHAIN OF SURVIVAL

Detection- by patient or bystander

Dispatch- calling emergency services

Delivery- prompt transport to appropriate Centre

Door to emergency triage

Data- prompt evaluation, laboratory studies and imaging

Decision –diagnosis and appropriate treatment

Drug administration or other interventions

Disposition- timely admission in intensive care unit

STROKE SYSTEMS OF CARE

Stroke systems of care integrate regional stroke facilities and acute stroke-ready hospitals with primary and comprehensive stroke centers. The goals of creating stroke systems of care include stroke prevention, community stroke education, proper use of emergency services, effective acute stroke care, and rehabilitation.

PRIMARY STROKE CENTER (PSC):

PSC improves stroke care in many ways (i.e.) by

- Shortening door to physician Contact time
- Door to CT time
- Door to intravenous rt-PA time
- Increasing rates of intravenous rt-PA use

COMPREHENSIVE STROKE CENTER (CSC):

CSC should be able to offer 24 hours per day, 7 days per week with state of the art care on the full spectrum of cerebrovascular diseases. In patients with acute ischemic stroke, admission to Neuro-Intensive Care units are done for those

- With severe deficits
- Large-volume infarcts
- Significant cerebral edema
- Significant comorbidities
- Blood pressure that is difficult to control
- Prior intravenous and intra-arterial recanalization interventions

ACUTE STROKE-READY HOSPITAL (ASRH)

ASRH are hospitals that effectively and efficiently evaluate, diagnose, and treat most stroke patients but they do not have inpatient stroke systems of care. After initial evaluation and treatment the patients are shifted to comprehensive stroke centers for overall care.

All ASRH have the following facilities

- Written emergency stroke care protocols
- Written transfer agreement with a hospital with neurosurgical expertise
- Ability to administer intravenous rt-PA
- Ability to perform emergency brain imaging.
- Ability to conduct emergency laboratory testing

TELEMEDICINE OR "TELESTROKE"[12]

Telemedicine (also called telestroke) help to solve the shortage of neurologists and radiologists, allowing hospitals to become acute stroke ready. Telemedicine provide acute stroke expertise to hospitals without full-time neurological services Tele stroke networks are reasonable for triaging patients with AIS who may be eligible for inter-facility transfer in order to be considered for acute interventions

TELE-RADIOLOGY

Tele-radiology is useful to obtain radiographic images at one location and transmit them to another for diagnostic and consultative purposes. Images can be transferred through internet or using smartphones[13] to the radiologist to obtain the diagnosis.

EVALUATION AND DIAGNOSIS OF STROKE

Patient suspected with acute stroke should be triaged[14] with same priority as that of myocardial infarction or trauma. Initial evaluation of stroke patient includes immediate stabilization of airway breathing and circulation as in other emergency patients.

TIMELINE FOR MANAGEMENT[15]

- Door to physician ≤10 minutes
- Door to stroke team ≤15 minutes

- Door to CT initiation ≤25 minutes
- Door to CT interpretation ≤45 minutes
- Door to drug (≥80% compliance) ≤60 minutes
- Door to stroke unit admission ≤3 hours

PATIENT HISTORY

Important information to be obtained is the time of onset of stroke. The time last when the patient was symptom free is asked for. The events occurring along with the occurrence of stroke should also be recorded. Wake up stroke can also be treated with thrombolysis if the imaging studies favor acute stroke with normal or early CT changes and fulfills the requisites for acute intervention.

CLINICAL SITUATIONS THAT MIMIC STROKE

- Psychogenic
- Seizures
- Hypoglycemia
- Migraine with aura
- Hypertensive encephalopathy
- Wernicke's encephalopathy
- CNS abscess

- CNS tumor
- Drug toxicity-lithium, phenytoin, carbamazepine

STROKE SCALES[16]

The use of a standardized neurological examination ensures that the components of a neurological examination are performed in a timely and uniform fashion. Formal stroke scores or scales, such as the NIHSS or Canadian Neurological Scale, may be administered by a broad spectrum of healthcare providers.

NATIONAL INSTITUTES OF HEALTH STROKE SCALE

The NIHSS[17,18] is an 11 item impairment scale, which provides a quantitative measure of key components of a standard neurological examination

The score assesses the following parameters

1. Level of consciousness
2. Best gaze
3. Visual fields
4. Facial paresis
5. Motor-arm
6. Motor-leg

7. Limb ataxia

8. Sensory

9. Best language

10. Dysarthria

11. Extinction or inattention

Each of the 11 items scores a specific ability between 0-4. Score 0 indicates normal function and higher score is indicative of impairment. Individual scores are summed up to get the final score. Scoring sheet is attached in annexure.

The minimum score is 0 and maximum score is 42. Severity of the stroke can also be assessed using NIHSS score (table-1).

Table - 1

Score	**severity**
0	No stroke symptoms
1-4	Minor stroke
5-15	Moderate stroke
16-20	Moderate to severe stroke
21-42	Severe stroke

1. LEVEL OF CONSCIOUSNESS:

Level of consciousness testing is in three sub- sections. The first section tests for the patient's responsiveness. The second section is the patient's ability to answer questions that are verbally asked by the examiner. The third section is based on the patient's ability to follow commands to perform some simple task. The scores are consolidated and represented in as a single component.

1.A. LOC RESPONSIVENESS

Table - 2

Score	Test results
0	Alert, responsive
1	Not alert, arousable verbally or by minor stimulation
2	Not alert, responsive to repeated and strong stimuli
3	Totally unresponsive , responds only with reflexes or areflexic

1.B. LOC QUESTIONS:

Patient is asked for his or her age and the current month of the year

Table - 3

Score	Test results
0	Answers both questions correctly
1	Answers one question
2	Does not answer both questions correctly

1.C. LOC COMMANDS

Patient is asked to do two commands, to open and close the eyes and to grip the hands. Commands can be repeated once only. Results are interpreted

Table - 4

Score	Test results
0	Can perform two commands.
1	Can perform one command.
2	Can’t perform both the commands.

2. BEST GAZE

Assess the ability to follow an object or pen

Table - 5

Score	Test results
0	Able to follow pen fully
1	Partial gaze palsy
2	Total gaze palsy, fixed to the side of lesion

3. VISUAL FIELD TEST

Visual fields tested by confrontation method and results are interpreted. Each eye is tested individually.

Table - 6

Score	Test results
0	No vision loss
1	Partial hemianopia or complete quadrantanopia
2	Complete hemianopia
3	Bilateral blindness

4. FACIAL PALSY

The movements of the facial expression are tested for partial or complete paralysis. UMN type of facial palsy is assessed. Symmetry of the face is noted in each facial expression.

Table - 7

Score	Test result
0	Normal and symmetrical
1	Minor paralysis
2	Partial paralysis
3	Complete facial paralysis

5. MOTOR ARM

The pronator drift test is performed in each upper limb. The patient is asked to extend his or her arm 90 degree out in the front. Observe for any downward drift of the arm within 10 seconds. Each arm should be tested individually for power. A maximum score of 4 for each arm totaling to 8 is interpreted.

Table - 8

Score	Test results
0	No arm drift
1	Arm drifts to intermediate position
2	Limited effort against gravity
3	No effort against gravity
4	No movement

6. MOTOR LEG

The patient is tested in supine position. One leg is lifted 30 degree above the horizontal and drift of the limb downwards in less than 5 seconds. Here also the score for individual legs are 4 totaling to 8.

Table – 9

Score	Test results
0	No leg drift
1	Drifts to intermediate position in 5 seconds
2	Limited efforts against gravity
3	No effort against gravity
4	No movement

7. LIMB ATAXIA

This is to test the intactness of the cerebellum. Finger Nose Test and Heel Knee Test are conducted. Both sides are tested separately. Patient's eye should be open when testing.

Table - 10

Score	Test result
0	Normal ,smooth, and coordinated movements
1	Ataxia in one limb
2	Ataxia in both the limbs

8. SENSORY

Tested using pin pricks. Individual dermatomes are tested and results are interpreted.

Table - 11

Score	Test results
0	No sensory deficit
1	Mild to moderate deficit
2	Severe deficit

9. LANGUAGE

The stroke scale includes a picture of a scenario. A list of simple sentences, a figure of assorted. Then the patient has to read the list of sentences and name the objects

Table - 12

Score	Test results
0	Normal
1	Mild to moderate aphasia
2	Severe aphasia, fragmented speech
3	Unable to speak or understand the speech

10 DYSARTHRIA

Dysarthria is the lack of motor skills required to produce understandable speech. It is the motor component of speech which is tested. The patient is asked to read out the list of words provided with the scale. Examiner observes the clarity and articulation of the words.

Table - 13

Score	Test result
0	Normal speech
1	Mild to moderate dysarthria
2	Severe dysarthria

11. EXTINCTION AND INATTENTION

This is tested by a technique referred as double simultaneous stimulation. Here the examiner alternatingly touches on right and left sides of the patient in various spots. Visual, tactile, auditory and spatial orientation is tested. The results are interpreted as

Table - 14

Score	Test results
0	Normal
1	Inattention to one side or one modality
2	Hemi-inattention no recognition of stimuli. Involvement of more than one modality.

USAGE OF NIHSS SCORE[18]

It is a standardized and repeatable assessment of stroke patients used by large multi-centric trials. It is the recommended scoring system by 2018 ASA/AHA guidelines on acute ischemic stroke. NIHSS used as soon as the

patient is admitted and then is repeated at regular intervals. It can also be used to monitor the response of therapy

NIHSS USE IN THROMBOLYSIS

A score of range 7-22 is indicated for thrombolysis. Score less than 7 indicate minor stroke. Hence it is not prudent to use thrombolytic since the risk of intracranial bleed is higher. Stroke presenting with score more than 22 are considered severe. Use of thrombolytic in major stroke is of minimum use since the area of occlusion is more involving major arteries it may not be possible to re-canalize the vessels fully. In addition the mortality in major strokes is high and general condition of the patient is also very poor.

MODIFIED NIHSS SCORE

It is the shorter version of the scale available. Some of the section are removed so as it can be easily applied by everyone. The simplified version is of more useful and is recommended for use of paramedical staff in assessing the patients prior to admission in hospital.

DRAWBACKS OF NIHSS

The score does not evaluate cranial nerves in detail. So it may be difficult to assess them separately while assessing the patient for thrombolysis. The score is also poor in assessing brainstem and cerebellar infarctions. Score may be low even in disabling strokes in these regions.

OTHER SROKE SCALES AVAILABLE

- Canadian Neurological Scale
- Scandinavian Stroke Scale
- Orogogozo Scale
- mTICI score
- Modified Mathew Scale

INITIAL DIAGNOSTIC EVALUATION OF PATIENTS WITH ACUTE STORKE

Several tests to assess for serious comorbid disease aid in treatment selection. Search for acute medical or neurological complications of stroke should be routinely emergently performed in all patients with suspected ischemic stroke. These are primarily to exclude important differential diagnosis.

The latest recommendations as per 2018 ASA/AHA guidelines are as follows

- Only the assessment of blood glucose must precede the initiation of IV rt-PA in all patients.
- Baseline ECG assessment is recommended in patients presenting with AIS, but should not delay initiation of IV rt-PA.

- Baseline troponin assessment is recommended in patients presenting with AIS, but should not delay initiation of IV rt-PA
- Usefulness of chest radiographs in the hyper acute stroke setting in the absence of evidence of acute pulmonary, cardiac, or pulmonary vascular disease is unclear. If obtained, they should not unnecessarily delay administration of IV rt-PA

OTHER DIAGONSTIC EVALUATIONS TO BE DONE SUBSEQUENTLY IN ALL PATIENTS:

- Oxygen saturation
- Serum electrolytes/renal function tests
- Complete blood count, including platelet count
- Markers of cardiac ischemia
- Prothrombin time(PT) / INR
- Activated Partial Thromboplastin Time (aPTT)
- ECG

INVESTIGATIONS TO BE DONE IN SELECTED PATIENTS

- TT if the patient is taking direct thrombin inhibitors or direct factor Xa inhibitors

- Hepatic function tests
- Toxicology screen
- Blood alcohol level
- Pregnancy test
- Arterial blood gas tests (if hypoxia is suspected)
- Chest radiography (if lung disease is suspected)
- Lumbar puncture (if subarachnoid hemorrhage is suspected and CT scan is not showing evidence of bleeding).
- Electroencephalogram (if seizures are suspected)

NEUROIMAGING

Neuro imaging[19] plays an important role in management of AIS. CT and MRI form the backbone of clinical assessment of acute ischemic stroke. There are many other clinical conditions that may mimic AIS. They are intracranial hemorrhage, seizure, sepsis, cardiogenic syncope, migraine, dementia, non-ischemic spinal cord pathologies, peripheral neuropathy, transient global amnesia, and brain abscess or tumor.

Modern imaging techniques are useful in establishing the diagnosis with a high degree of certainty in the very rapid time.

NON-CONTRAST CT (NCCT)[20]

The primary purpose of NCCT in the acute stroke setting is to diagnose ischemic stroke, and to exclude acute intracranial hemorrhage. Frank ischemia or hemorrhages are easily visible in NCCT. NCCT remains easiest and rapid method to assess the patient condition in emergency situations. Availability of CT centers is also widespread in our country and CT can be done within minutes of arriving in the emergency room. Even when the patients arrive in time if they intracranial hemorrhage or an evolved stroke they cannot be thrombolysed. Thus NCCT remains an important tool for initial evaluation[21] of ischemic stroke.

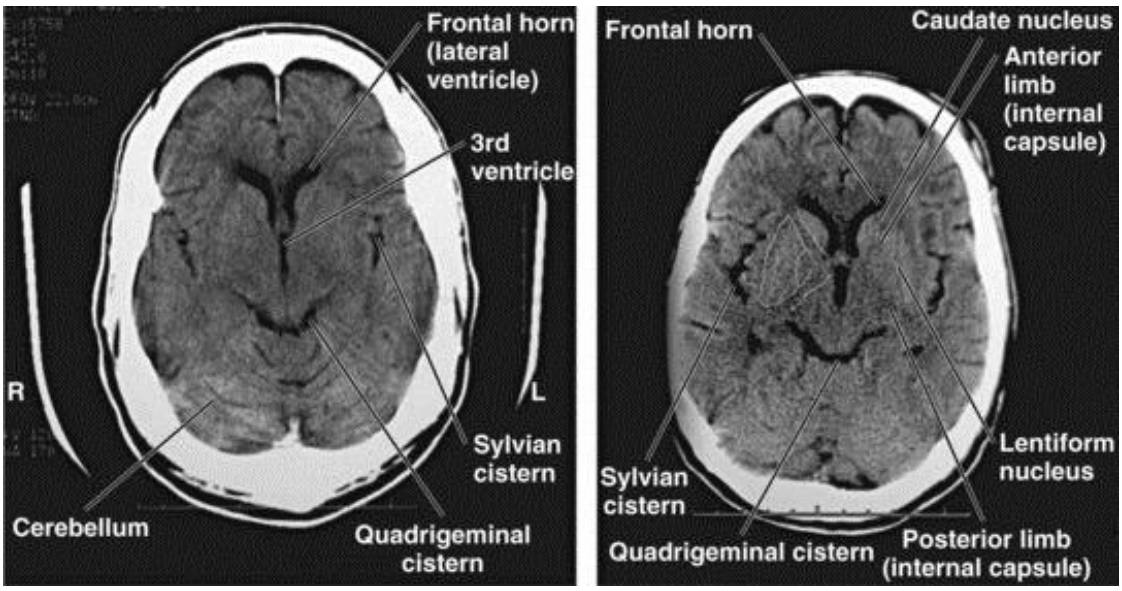


Figure - 4 Normal CT

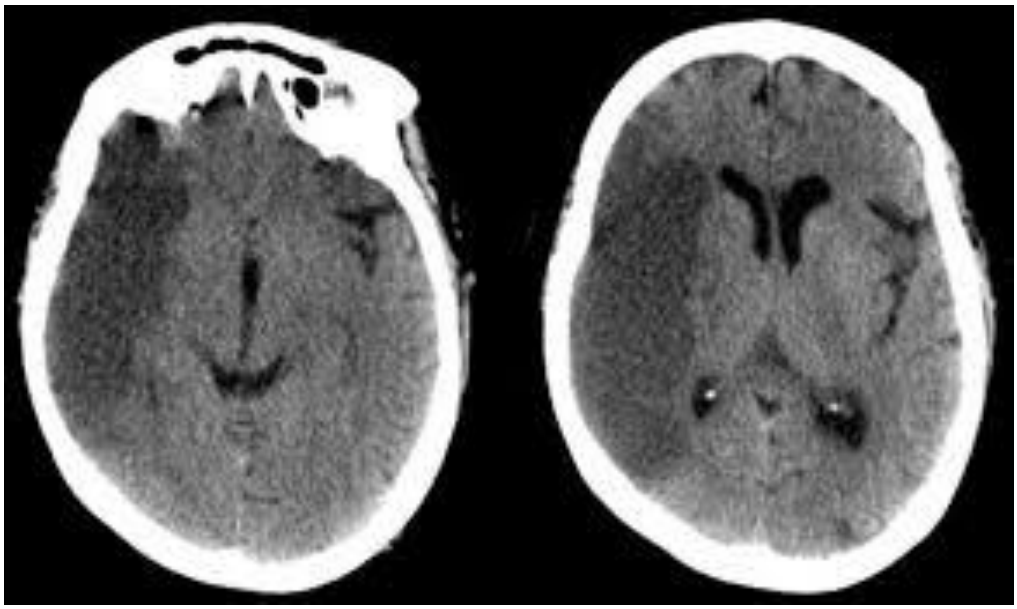


Figure-5 CT with frank ischemic infarction.

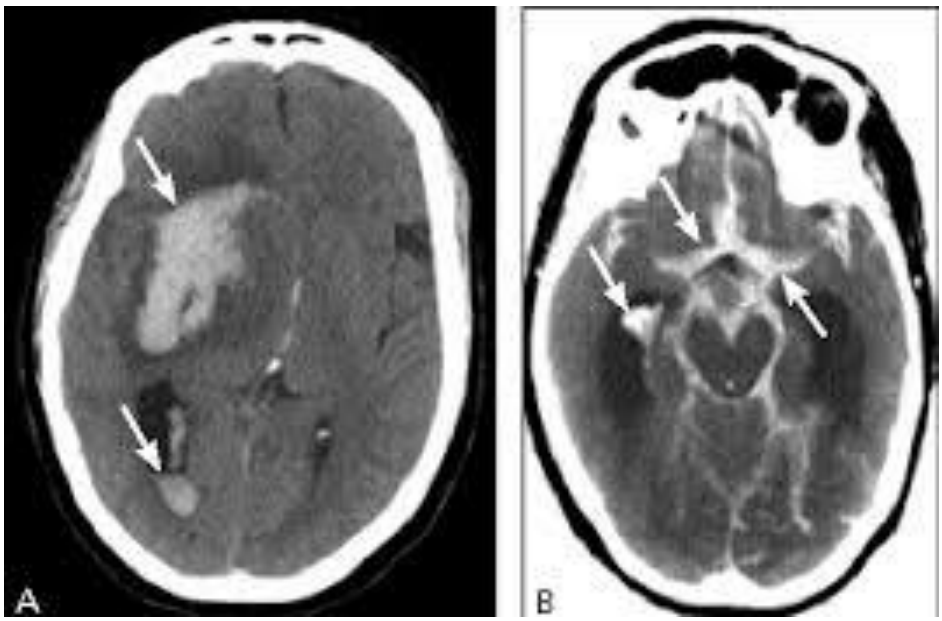


Figure -6 CT with intra-cerebral (A) and sub arachnoid hemorrhage(B)

EARLY CT CHANGES[22] IN AIS

Early decreases in the CT density of ischemic tissue are appreciated only indirectly. The following are the early changes CT after ischemia before developing frank infarct.

LOSS OF GREY-WHITE MATTER DIFFERENTIATION

The process of decrease in CT density initially affect gray matter more than white matter. Decreasing the radio density of affected gray matter slightly, so that it approaches that of adjacent white matter. The loss of gray matter–white matter differentiation is a commonly described early sign of acute infarction on NCCT

OBSCURATION OF LENTIFORM NUCLEUS

When infarction is in the territory of the middle cerebral artery (MCA), this is often manifested as obscuration of the basal ganglia and the lentiform nucleus.

LOSS OF SULCAL EFFACEMENT

Early edema is visible because the increase in volume of brain tissue. This causes effacement of nearby cerebral sulci, cisterns, or ventricles. Thus there is no normal space between the sulci and gyri.

INSULAR RIBBON SIGN

When infarction is in the territory of MCA, may present as the ‘‘Insular Ribbon Sign’’ in which the ribbon of gray matter in the insular cortex becomes indistinguishable from the subcortical white matter

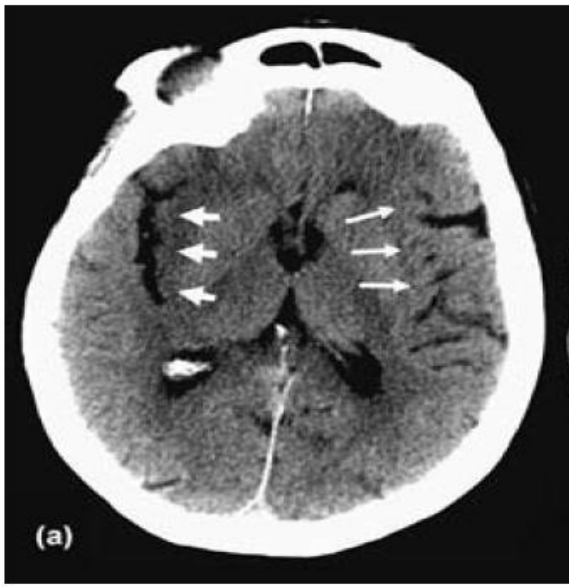


Figure-7 Insular Ribbon sign

HYPERDENSE MCA SIGN[23]

Emboli are more radio dense than normal brain tissue. So an affected proximal MCA may appear as a linear hyper density in the sylvian fissure this is known as‘‘Hyperdense Middle Cerebral Artery sign’’ or HMCA sign.

Figure-8: Hyperdense MCA sign

MCA DOT SIGN[24]

Hyper dense embolic material in more distal MCA branch, within the Sylvian fissure which is oriented in perpendicular plane of imaging may appear as a small, rounded hyperdensity. This is known as ‘‘MCA dot sign.’’

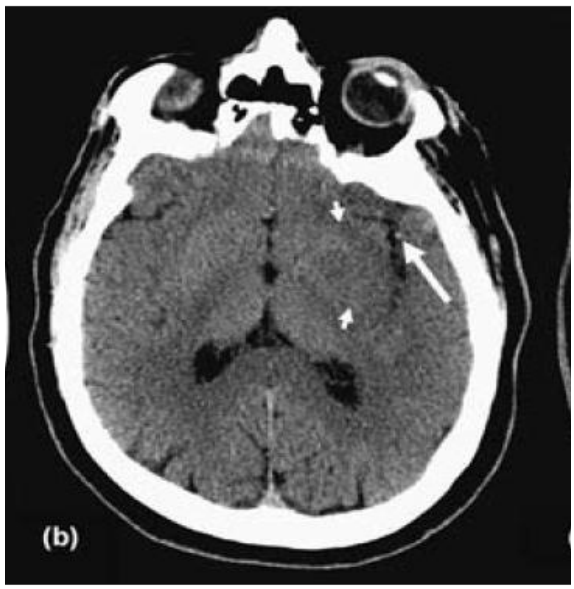


Figure-9: MCA dot sign

THE ALBERTA STROKE PROGRAMME EARLY CT SCORES (ASPECTS)[25]

The Alberta Stroke Programme Early CT Score (ASPECTS) helps to improve reliability in CT reading, even among non-expert. It provides a framework for quantifying the extent of ischemic hypodensity in early NCCT scans. In ASPECTS, each of the 10 distinct regions in the territory of the MCA is assigned a score of 0 or 1 depending on the presence or absence of hypodensity.

One point is subtracted from 10 for each early CT change. Thus, a score of 10 indicates no hypodensity 0 reflects hypodensity. ASPECTS is helpful in diagnosing acute stroke, and to decide whether or not thrombolytic therapy is to be administered. ASPECTS scores of 7 or less indicates presence of hypodensity and associated with an increased risk of thrombolysis-related parenchymal hemorrhage.

CONVENTIONAL MRI

The conventional MRI is capable of detecting early changes in neural tissue. Because of vasogenic edema, which introduces mobile water protons into ischemic tissue the ischemic region is visible as hyperdense areas due to increased signal intensity

MRI-FLAIR

T2-weighted fluid-attenuated inversion recovery (FLAIR) imaging provide increased sensitivity. It shows hyper intense lesions in the ischemic regions better than the conventional MRI.

OTHER SIGNS OF ACUTE STROKE ON MRI

- Loss of vascular flow voids
- Arterial hyperintensity in FLAIR images
- Vascular contrast enhancement signifying stasis of blood
- Effacement of sulci, cisterns, and ventricles due to mild swelling.

DIFFUSION-WEIGHTED MRI (DWI)[26]

A major breakthrough in stroke imaging occurred with the development of diffusion- weighted MRI (DWI). DWI produces images that are T2-weighted and diffusion-weighted. Diffusion weighted means that different parts of the brain appear brighter or darker depending on the rate of water diffusion within them.

Diffusion is also known as Brownian motion[27], which is the random motion that all molecules exhibit when at temperatures above absolute zero. In brain tissue, this motion is reduced by physical barriers like cell membranes and

cytoskeletal macromolecules. DWI is able to depict microscopic pathologic changes by demonstrating changes in water diffusion[28].

In ischemic brain tissue, diffusion of water molecules becomes markedly restricted, within minutes of the onset of ischemia, because of cytotoxic edema.

Cytotoxic edema is distinct from vasogenic edema, occurs due to an accumulation of ions in the intracellular space. This leads to cellular swelling, but not tissue swelling which is depicted as a hyperintense lesion in diffusion-weighted images.

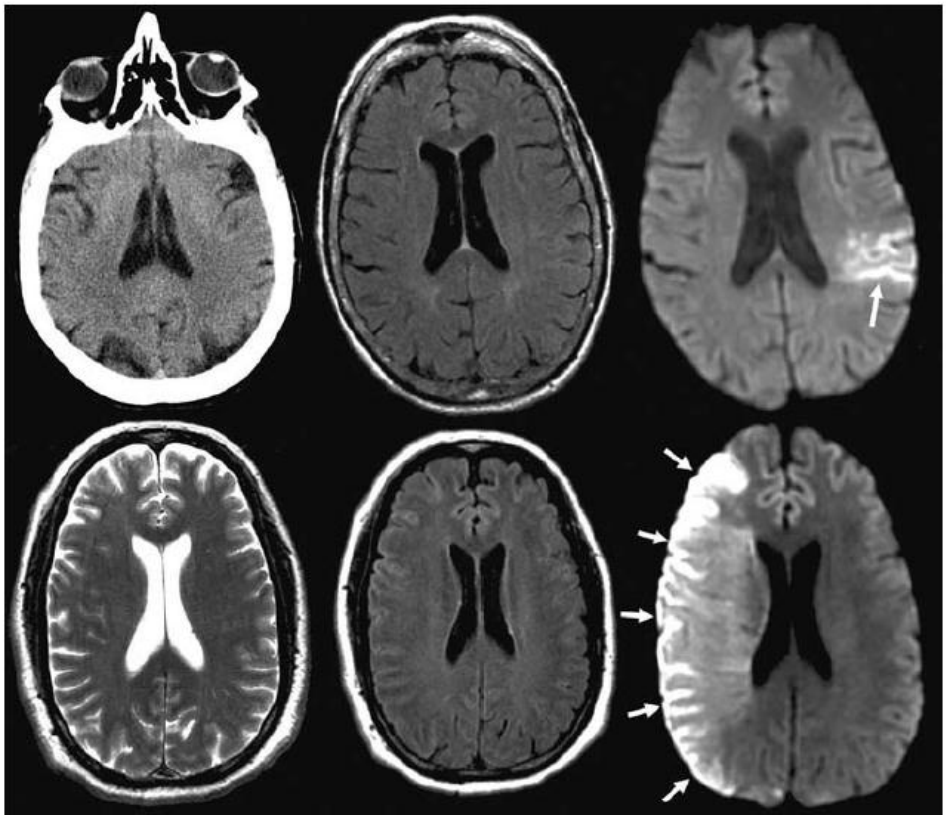


Figure -10 comparison of CT, MRI and diffusion weighted image

MAGNETIC RESONANCE ANGIOGRAPHY

MRA can be divided into contrast-based techniques and non-contrast based techniques.

There are two non-contrast based MRA techniques

- Time-of-flight(TOF) MRA
- Phase contrast (PC) MRA.

MRA can also be performed with intravenously injected bolus of a gadolinium-based contrast material

CT ANGIOGRAPHY

CT angiography (CTA)[30] is a technique that provides high-resolution vascular images using the same CT scanners that are used for conventional CT imaging. The Iodine-based contrast agents are used for conventional contrast-enhanced CT

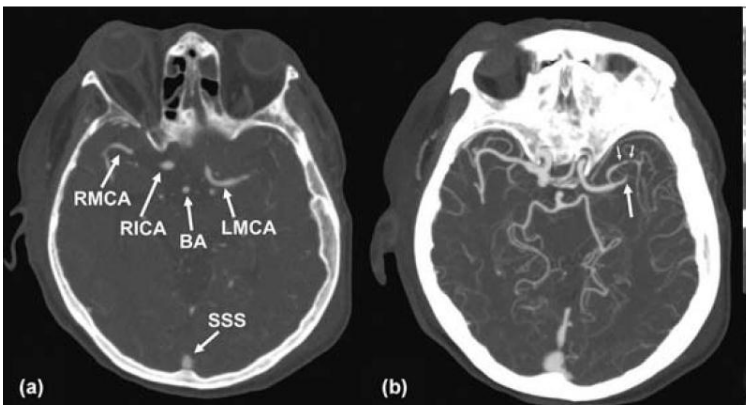


Figure -11 CT angiography.

2018 AHA/ASA GUIDELINES REGARDING NEURO IMAGING FOR AIS

- All patients with suspected AIS should undergo NCCT to provide information to make decisions on treatment modality
- Brain imaging should be done within 20 minutes of arrival to the hospital in patients who are candidates for IV rt-PA.
- Early CT changes should not be used as a criteria to withhold the therapy who otherwise qualify
- Routine use of MRI before IV rt-PA administration is not recommended
- MRI and other imaging should not delay the administration of therapy with IV rt-PA.

SUPPORTIVE CARE AND TREATMENT OF ACUTE COMPLICATIONS IN PATIENTS OF AIS

AIRWAY, VENTILATORY SUPPORT

Assessment of the airway, breathing, and circulation occurs in the pre-hospital and on arrival in emergency room. If the there is any problem with the above it should be corrected promptly.

HYPOXIA

Common causes of hypoxia are

- Partial airway obstruction,
- Hypoventilation,
- Aspiration,
- Atelectasis and pneumonia
- Impaired oropharyngeal mobility
- Loss of protective reflexes
- Central periodic breathing (Cheyne-Stokes respirations)

PATIENT POSITIONING[32]

Non-hypoxic patients, a supine position[33,34] is recommended. Patients at risk for airway obstruction or aspiration should have the head of the bed elevated 15° to 30°

TEMPERATURE[35,36]

HYPERTHERMIA

About one third of patients admitted with stroke will be hyperthermic (temperature >37.6°C) in the first one hour of onset. Hyperthermia is associated with poor neurological outcome, due to increased metabolic demands, increased

release of neurotransmitters, and free radical production. Hyperthermia may also be the cause of stroke, like infective endocarditis. It may be due to a complication, like pneumonia, urinary tract infection or sepsis [37].

HYPOTHERMIA

Benefits of induced hypothermia which can protect the brain in the presence of global hypoxia or ischemia are not established. Efforts to reduce the temperature are not needed.

CARDIAC MONITORING

Continuous cardiac monitoring is indicated for at least the first 24 hours after stroke. Occurrence of atrial fibrillation and other cardiac arrhythmias is carefully monitored.

ACUTE STROKE AND BLOOD PRESSURE[38]

ARTERIAL HYPERTENSION

The blood pressure monitoring in patients with AIS is very essential in the setting of IV thrombolysis. Generally patients presented with SBP of >139mmHg were 77% and >184 mmHg were 15%[38].

Blood pressure reduces spontaneously starting within 90 minutes after onset of stroke symptoms. Extreme arterial hypertension is clearly detrimental, because it leads to encephalopathy, cardiac complications, and renal insufficiency

Moderate arterial hypertension during acute ischemic stroke might be advantageous by improving cerebral perfusion of the ischemic tissue.

OPTIONS TO TREAT ARTERIAL HYPERTENSION IN PATIENTS WITH AIS

PATIENTS ELIGIBLE FOR ACUTE REPERFUSION THERAPY AND BP IS >185/110 MM HG[39]

- Labetalol 10–20 mg IV over 1–2 min, may repeat 1 time
- Nicardipine 5 mg/h IV, increase 2.5 mg/h every 5–15 min, maximum 15 mg/h.
- Clevidipine 1–2 mg/h IV, double the dose every 2–5 min until desired BP reached; maximum 21 mg/h
- Other agents like hydralazine, enalaprilat may also be considered
- If BP is not maintained ≤185/110 mm Hg, do not administer alteplase

MANAGEMENT OF BP DURING AND AFTER ALTEPLASE IS TO MAINTAIN BP ≤180/105 MM HG

- Monitor BP[40] every 15 min for 2 h from the start of alteplase therapy
- Every 30 min for 6 h
- Every hour for 16 h

IF SYSTOLIC BP >180–230 MM HG OR DIASTOLIC BP >105–120 MM HG [43,44,45]

- Labetalol 10 mg IV stat followed by continuous IV infusion 2–8 mg/min.
- Nicardipine 5 mg/h IV, dose increased up to desired effect by 2.5 mg/h every 5–15 min, maximum 15 mg/h
- Clevidipine 1–2 mg/h IV, titrate by double the dose every 2–5 min until desired BP reached- maximum 21 mg/h
- If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside

INTRAVENOUS FLUIDS

Patients presenting with acute ischemic stroke are either euvolemic or hypovolemic. Hypovolemia may lead to hypoperfusion and exacerbate the ischemic brain injury.

Hypervolemia may exacerbate ischemic brain edema. Thus euvolemia is desirable. Appropriate IV fluids should be infused to the patient to maintain euvolemic status.

BLOOD GLUCOSE LEVELS[46]

HYPOGLYCEMIA

Blood glucose should be measured in all patients with acute ischemic stroke. Autonomic symptom like sweating, trembling, or anxiety appear when the blood glucose level reduces less than 57 mg/dl. Brain dysfunctions like disorientation, dizziness begin to appear when the glucose level is below 47 mg/dl. It is important to correct the levels with slow IV infusion of dextrose containing solutions.

HYPERGLYCEMIA[47,48]

It has been shown by several studies that the admission blood glucose is elevated in >40% of patients with AIS. Most of the patients with hyperglycemia are diabetics, hence special care should be taken to reduce the blood sugar to the desirable levels i.e 140-180mg/dl. Short acting insulin can be used. Serial monitoring of blood glucose levels are desirable.

HIGHLIGHTS OF 2018 AHA/ASA GUIDELINES REGARDING SUPPORTIVE CARE

- Airway and ventilatory support is recommended for patients with decreased consciousness or compromised airway.
- Oxygen supplementation not needed in non-hypoxic patients
- In hypoxic patients it should be given to maintain saturation >94%

- Euvolemic status to be maintained
- Hyperthermia to be treated with anti-pyretics
- No role for induced hypothermia established
- Blood glucose levels optimally maintained between 140 and 180mg/dl
- In patients with elevated blood pressure who are eligible for IV therapy, it should be carefully lowered to the levels SBP <185mmHg and DBP <110mmHg

INTRAVENOUS FIBRINOLYSIS[48]

Intravenous fibrinolytic therapy for acute stroke is now widely accepted. The US FDA approved the use of intravenous rt-PA in 1996 on the basis of NINDS rt-PA Stroke Trial. Thrombolytic therapy with IV rt-PA is the most effective treatment for acute ischemic stroke.

RATIONALE FOR THERAPY

The reduced cerebral blood flow due to acute arterial occlusion reduces oxygen and glucose supply to the brain tissue[49]. It leads to

- Lactic acid production
- Blood–brain barrier breakdown
- Inflammation

- Sodium and calcium pump dysfunction,
- Glutamate release and intracellular calcium influx
- Free-radical generation
- Membrane and nucleic acid breakdown
- Cell death.

Brain tissue with cerebral blood flow <8–10 mL/100 g/min will not survive. While brain tissue with cerebral blood flow 18–20 mL/100 g/min makes the tissue nonfunctional. This tissue may recover from permanent damage if the blood flow is restored rapidly within the time. It is the basis of the concept of the ischemic penumbra surrounding a zone of irreversible damage Restoration of blood flow to the penumbra is the goal of thrombolytic therapy. The window period for treatment with IV rt-PA is < 4.5 hrs from the onset of symptoms. Late reperfusion may be associated with reperfusion injury and hemorrhagic transformation of the infarction with worser outcomes than without treatment.

INTRAVENOUS THROMBOLYTICS

Thrombolytic agents[50] are drugs which cause dissolution of thrombi. They act by converting inactive plasminogen into plasmin which is a serine protease. The plasmin then cleaves fibrin within the thrombus.

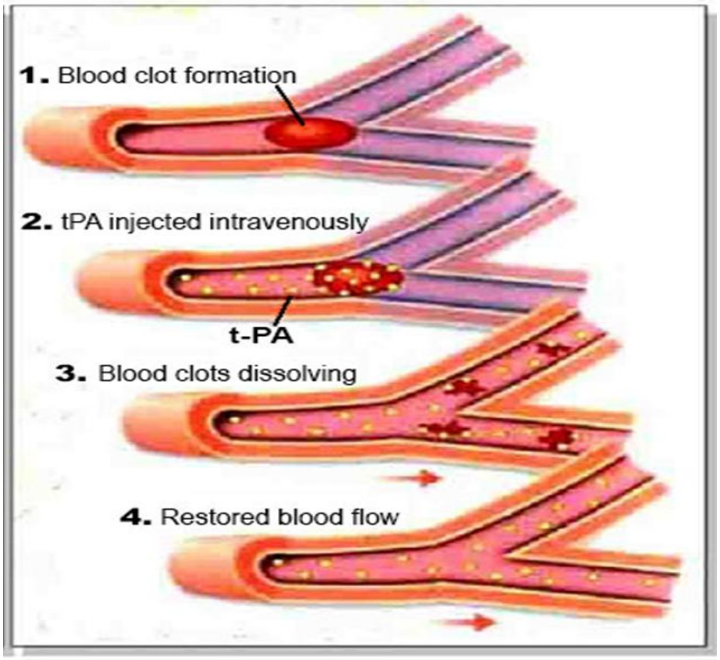


Figure -12 mechanism of action of thrombolysis

Intravenous thrombolytic agents that can be used for stroke thrombolysis are as follows

- Human rt-PA(Alteplase)[55]
- Tenectiplase
- Urokinase
- Streptokinase
- Desmoteplase.

Only alteplase and tenecteplase are the two drugs which are FDA approved for IV thrombolysis. Other drugs are not of proven benefit in treatment of AIS[56].

Administration of these agents cause[59]

- systemic fibrinogen degradation
- reduction in plasminogen and a2-antiplasmin
- inactivation of factors V and VIII
- platelet disaggregation and platelet dysfunction
- systemic hypofibrinogenemia
- prolongation of aPTT and coagulopathy.

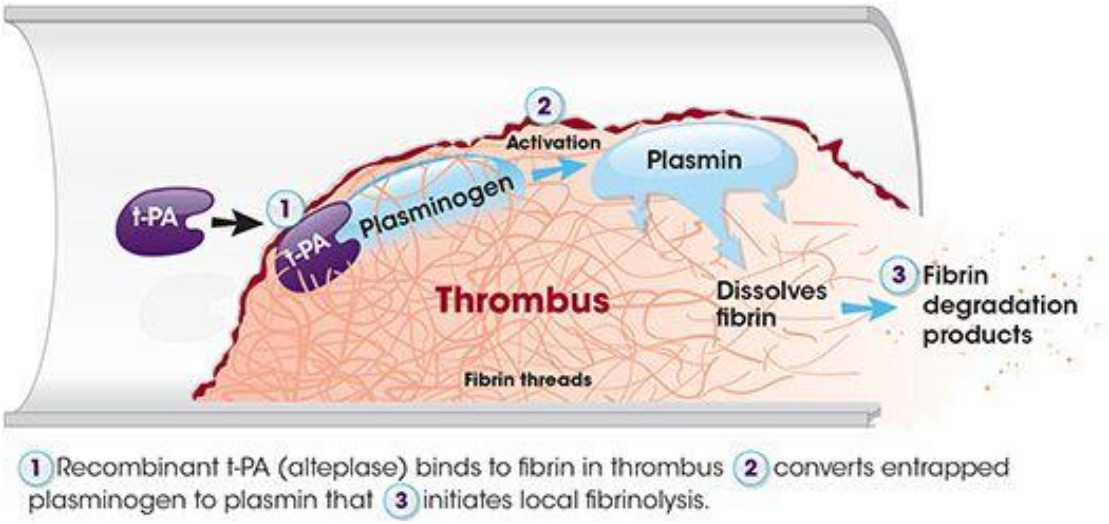


Figure- 13 Mechanism of action of IV rt-PA

DOSE AND ADMINISTRATION

ALTEPLASE[59]

IV alteplase is given in the dose of 0.9 mg/kg maximum of 90mg 10% of the dose is given as bolus over 1 minute Remaining dose is given as IV infusion over 1 hour

TENECTIPLASE

IV tenectiplase can be given as a single dose.

0.4mg/kg as IV bolus.

Delay nasogastric tube insertion, bladder catheterization or other catheterization.

Follow up CT or MRI at 24 hours.

INDICATIONS[60,61]:

- Class I recommendations- strong benefit
- Class II recommendations- moderate or weak benefit

CLASS I RECOMMENDATIONS:

- Patients with acute ischemic stroke presenting within 3hrs of onset of symptoms
- Age ≥18 and <80 yrs
- Stroke severity NIHSS score <25

- Normal NCCT or early CT changes with ASPECT score < 6
- In selected patients presenting between 3- 4.5 hours(< 80yrs, no prior diabetes or stroke, not on oral anticoagulants and without imaging evidence of infarct)
- Patients on single or dual antiplatelet drugs
- ESRD patients on HD with normal aPTT

CLASS II RECOMMENDATIONS

- Extended 3-4.5 hours[62] for age >80 years
- Patients on warfarin with INR <1.7
- Within 0-3hrs window with mild stroke i.e NIHSS< 4
- 3-4.5 with severe stroke NIHSS >25
- Pre-existing disability mRS score >2
- Blood pressure >185/110 mmHg(to be corrected to<185/110mmHg)
- Hypoglycemia and hyperglycemia(to be maintained between 140-180mg/dl)
- Seizure at onset
- Dural or lumbar puncture in last 7days

- Arterial puncture in last 7 days
- Recent major trauma within 14 days not involving head
- Recent major surgeries within 14 days
- Menstruation with no history of menorrhagia
- Small <10mm unruptured intracranial aneurysms
- Cranial microbleeds(CMB) 1-10 number on MRI
- Extra-axial intracranial neoplasms
- Acute MI if immediate PCA is indicated
- Recent MI within 3 months
- Cardiac diseases- cardiologist consultation is needed
- Procedural stroke –during cardiac or cerebral angiography
- Systemic malignancy with life expectation >6 months
- Pregnancy
- Hemorrhagic ophthalmic conditions
- Sickle cell disease
- Illicit drug users
- Stroke mimics

CONTRAINDICATIONS (CLASS III RECOMMENDATIONS): (no benefit or cause harm)

- Time of onset more than 4.5hrs
- CT showing acute intracranial hemorrhage, acute frank infarct, ASPECT < 6 [63.]
- Ischemic stroke within 3 months
- Severe head trauma within 3 months
- Intracranial / intraspinal surgeries within 3 months
- Previous history of intracranial hemorrhage
- Subarachnoid hemorrhage
- GI bleed within 21 days
- GI malignancy
- Coagulopathy (platelet<1,00,000/mm^3,INR >1.7, aPTT >40 sec, PT >15 sec)
- LMWH or unfractionated heparin in past 24 hours
- Patients on Thrombin inhibitors or Direct Xa inhibitors
- Patients on glycoprotein IIb/IIIa inhibitors

- Infective endocarditis
- Aortic arch dissection
- Intra-axial intracranial neoplasms

COMPLICATIONS

The complication following IV alteplase infusion is relatively minimal but maybe life threatening. They are as follows

- Minor skin rash
- Anaphylactic reactions and angioedema
- Minor intracranial bleed[67]
- Major intracranial bleed[67]
- Extracranial bleeding manifestation
- Other complications

ANGIOEDEMA AND ANAPHYLAXIS[68]

Angioedema reaction comprise of swelling of tongue, lips or oropharynx. They are usually mild transient and occurs mostly on the opposite side of ischemic hemisphere. Occurs in about 1.3%-5.1% 0f all patients who receive alteplase.

MANAGEMENT[69]

- Maintenance of airway
- Discontinue alteplase infusion
- Administration of IV methylprednisolone 125mg
- Administration of IV diphenhydramine 50mg
- Administration of IV ranitidine 50mg or IV famotidine 20mg
- If there is increase in edema administer adrenaline 0.1% 0.3ml s.c
- Icatibant selective bradykinin B2 receptor antagonist 30mg s.c in abdominal area
- Supportive measures

INTRACRANIAL BLEEDS[67]

Intracranial hemorrhage is the most feared complication of thrombolytic therapy. The hemorrhages are divided into

- Hemorrhagic transformation - small petechiae without mass effect
- Parenchymal hematoma – consisting of blood clot.

They are also divided as

- Asymptomatic or minor bleeds
- Symptomatic or major bleeds(sICH)

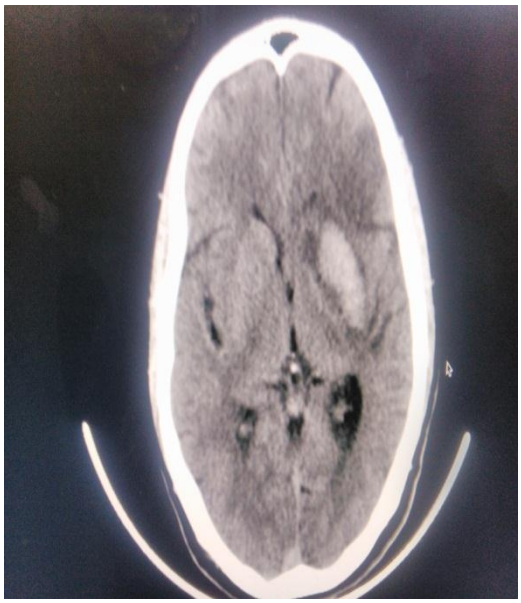


Figure-12 minor bleed after thrombolysis.

Most of the sICH is caused by parenchymal bleed leading to mass effect and may also be life threatening. The risk factors for developing sICH are

- Effect of drug IV rt-PA
- Extent of hypoattenuation pretreatment CT
- History of cardiac failure
- Increasing age
- Increased baseline blood pressure
- Previous treatment with asprin.

MANAGEMENT OF INTRACRANIAL BLEED:

- Stop alteplase infusion
- CBC, PT (INR), aPTT, fibrinogen level, blood grouping and cross-match
- Emergency NCCT
- Cryoprecipitate (includes factor VIII): 10 U infused over 10–30 min.
- Administer additional dose for fibrinogen level of <200 mg/dL
- Tranexamic acid 1000 mg IV infused over 10 min
- ε-aminocaproic acid(4–5 g over 1 h, followed by 1 g IV until bleeding is controlled)
- Hematology and Neurosurgery consultations
- Supportive therapy, including BP management, temperature, and glucose control

ENDOVASCULAR INTERVENTIONS[70]

- Mechanical Clot Disruption/Extraction(thrombectomy)
- Intra-arterial Fibrinolysis
- Acute angioplasty and stenting

MECHANICAL THROMBECTOMY

The patients who are eligible for mechanical thrombectomy are selected by the following criteria

- Prestroke mRS score of 0 to 1
- Occlusion of the internal carotid artery or MCA segment 1 (M1) but can also be used for other vessels also
- Age ≥18 years
- NIHSS score of ≥6
- ASPECTS of ≥6
- Treatment can be initiated within 6 hours of symptom onset.
- The shorter the time window of thrombectomy better the results will be.
- MERCI-Mechanical Embolus Remover in Cerebral Ischemia is the device approved for thrombectomy.

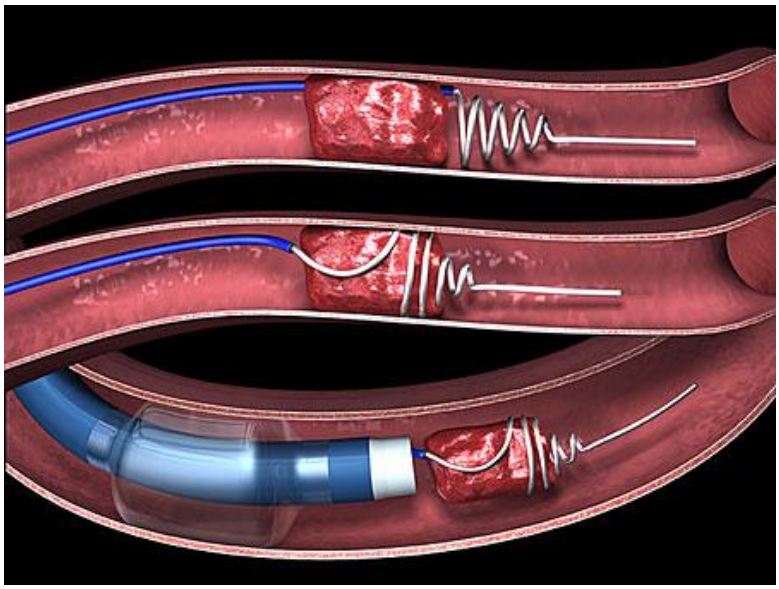


Figure – 13 MERCI Retriver

INTRACRANIAL ACUTE ANGIOPLASTY AND STENTING

Urgent angioplasty with adjunctive stent placement is used to restore antegrade flow, with or without fibrinolysis or clot extraction. Retrievable stents are the newest approach to endovascular recanalization. These stent retrievers reperfuse tissue immediately and then used to engage and retrieve the clot.

ANTI-PLATELET DRUGS[71,72,]

For those treated with IV alteplase, aspirin administration is generally delayed until 24 hours later. The use of glycoprotein IIb/IIIa receptor antagonists, like abciximab, in the treatment of AIS is potentially harmful and hence contraindicated.

In patients presenting with minor stroke, treatment for 21 days with dual antiplatelet therapy (aspirin and clopidogrel) begun within 24 hours can be

beneficial for early secondary stroke prevention for a period of up to 90 days from symptom onset.

ANTICOAGULANTS[72]

Use of anticoagulants in the treatment of AIS is found to have no benefit. In fact it causes more harm and so use of heparin or heparinoids for urgent management of AIS is contraindicated.

Use of factor Xa inhibitors are also not useful. When the patient is already on these drugs IV thrombolysis or other interventions are contraindicated.

Thrombin inhibitors like Agatroban and Dabigatron are also tried for treatment of AIS but they are of limited use and there is no sufficient supporting evidence till now.

SURGICAL INTERVENTIONS IN AIS[67]

Cerebral and cerebellar edema is one of the important sequelae of AIS.

In patients with unilateral MCA infarctions who deteriorate neurologically within 48 hours despite medical therapy, decompressive craniectomy with dural expansion may be useful since it reduces mortality. Ventriculostomy is recommended in the treatment of obstructive hydrocephalus after a cerebellar infarct. Decompressive suboccipital craniectomy with dural expansion should be performed in patients with cerebellar infarction.

Use of osmotic therapy like mannitol infusion in patients with clinical deterioration can be encouraged. Use of brief moderate hyperventilation is a treatment option for patients with acute severe neurological decline from brain swelling.

OTHER EXPERIMENTAL THERAPIES

- Volume Expansion, Vasodilators
- Induced Hypertension
- Albumin for Treatment of Acute Ischemic Stroke [73,74]
- Mechanical Flow Augmentation
- Neuroprotective Agents
- Hypothermia
- Hyperbaric Oxygen
- Near-Infrared Laser [75-78] Therapy

All the above therapeutic interventions are in experimental levels and are of no proven benefit. These are not recommended as per latest guidelines.

SUPPORTIVE MEASURES AFTER THROMBOLYSIS AS IN-PATIENT IN HOSPITAL

- All patients to be taken care in Neuro ICU for atleast 24 hours.
- Blood pressure, euvolemic status, blood glucose levels and temperature are maintained as recommended.
- Prevention of aspiration and use of dysphagia screening
- Nutrition and oral hygiene is taken care of.
- DVT prophylaxis in immobile patients
- Screening for post stroke depression.
- Routine antibiotic prophylaxis is not recommended
- Skin care and prevention of bedsores.
- Rehabilitation and physiotherapy.
- Smoking cessation and risk factor modification.
- Stroke education for patients and caregivers.

FOLLOW UP

The outcome of patients undergoing acute thrombolysis is assessed after 3 months. The real good outcome[79] of the therapy lies in not in treating the patient acutely or administering the drug in time, it is the quality of life the patient

attains after the therapy. The real success of therapy is attaining fully independent and productive life. This is assessed by regular follow up of the patient after discharge. The reassessment of patient is done usually at the end of 3 months. Many scales are available for assessment of disability and dependency of patient in the post stroke period. They are

- Modified Rankin Score(mRS)[80]
- Barthel index
- Glascow outcome scale.

Of the above the most accepted scale is modified Rankin score.

MODIFIED RANKIN SCORE[80]

The score was originally devised by Dr.John Rankin and then modified by Prof.C.Warlow. The modified version is now the widely accepted scale used all over the world for academic purposes the scale consists of score from 0-6. A score of 0-2 is considered a good outcome. It is the positive outcome of the therapy given.

Table - 15

CLINICAL OUTCOME	SCORE
No symptoms	0
No significant disabilities, despite symptoms, able to perform all usual duties and activities	1
Slight disability, unable to perform all previous activities, but able to look after own affairs without assistance	2
Moderate disability, requires some help, but able to walk without assistance	3
Moderately severe disability, unable to walk without assistance and unable to attend own bodily needs without assistance	4
Severe disability, bedridden, incontinent and requires constant nursing care and attention	5
Death	6

MATERIALS AND METHODS

This study was conducted at a tertiary care hospital during the period from March 2018 to August 2018, after getting ethics committee clearance.

Type of Study: Prospective descriptive study.

Study center: Tertiary care Centre in Chennai

AIM OF THE STUDY

The aim of present study is to assess the clinical outcome and improvement in quality of life of patients undergoing intravenous thrombolysis for acute ischemic stroke in tertiary care center

PRIMARY OBJECTIVES

To study the clinical profile of patients undergoing thrombolysis for acute stroke presenting within window period (4.5hrs).

SECONDARY OBJECTIVE

To study the improvement in physical quality of life after intravenous thrombolytic therapy in acute ischemic stroke.

STUDY BACKGROUND

Acute stroke is one of the major health problem causing mortality and long term morbidity and disability worldwide.

Neural tissue is very sensitive to ischemic insult and causes permanent disability once the treatment is delayed.

Modern management of stroke includes rapid assessment, protocol wise approach, thrombolysis for acute ischemic stroke, early specialist management and appropriate monitoring.

Thrombolysis is a key intervention for patients presenting early within window period of 4.5 hours. Long term outcome of the therapy is to improve physical quality of life and reduction of dependency on others.

JUSTIFICATION OF STUDY

Positive outcome of the study encourages use of thrombolysis extensively, as an important modality of treatment of acute stroke in future

INCLUSION CRITERIA

- Age >18 years<80 years
- Onset of symptoms to time of drug administration <4.5hrs
- Measurable neurological deficit defined as impairment of language, motor function, cognition and/gaze, vision or neglect
- Score for stroke severity >4 on the NIHSS score

EXCLUSION CRITERIA

1. Age >80 yrs

2. Minor stroke(NIHSS<4) / major stroke(NIHSS>22)

3. Prior use of antiplatelet / GI bleed in preceding 21 days

4. Stroke /TIA/Head injury in preceding 3months

5. Myocardial infarction in preceding 3 months

6. Major surgeries in preceding 14 days

7. Radiologically demonstrable stroke with ASPECT score <6

Sample size: 30

PROCEDURE

The detailed history of the patients was recorded and patients underwent a detailed clinical examination. Patients were assessed according to NIHSS score at the time of admission. Early routine investigations including imaging with non –contrast CT scan were done. Patients were thrombolysed using intra venous Alteplase 0.9 mg/kg (10% of dose as bolus and 90% over hour). After administration of intravenous thrombolytics, patients were observed in ICU. Reassessment of patient was done after 24 hours to look for primary outcome i.e decrease in NIHSS score by ≥4 indicating good prognosis in that patient. Repeat CT is done to rule out any bleeding complications.

After stabilizing the patient they were started on routine stroke management with anti-platelets and rehabilitation therapy. Patients were discharged and routinely followed up. At the end of 3 months patients were assessed by using Modified Rankin Score. This scoring provides the clinical outcome and improvement in quality of life in post stroke period.

INFORMED CONSENT

Consent form was written in both English and Tamil and consent obtained from all the participants, confidentiality is maintained.

STATISTICAL ANALYSIS

The results are analyzed using IBM.SPSS statistical software. Continuous variables are expressed as mean standard deviation. Categorical variables are expressed as percentage.

* **Conflict of interest if any -** Nil

* **Privacy/confidentiality of study subjects -** Maintained

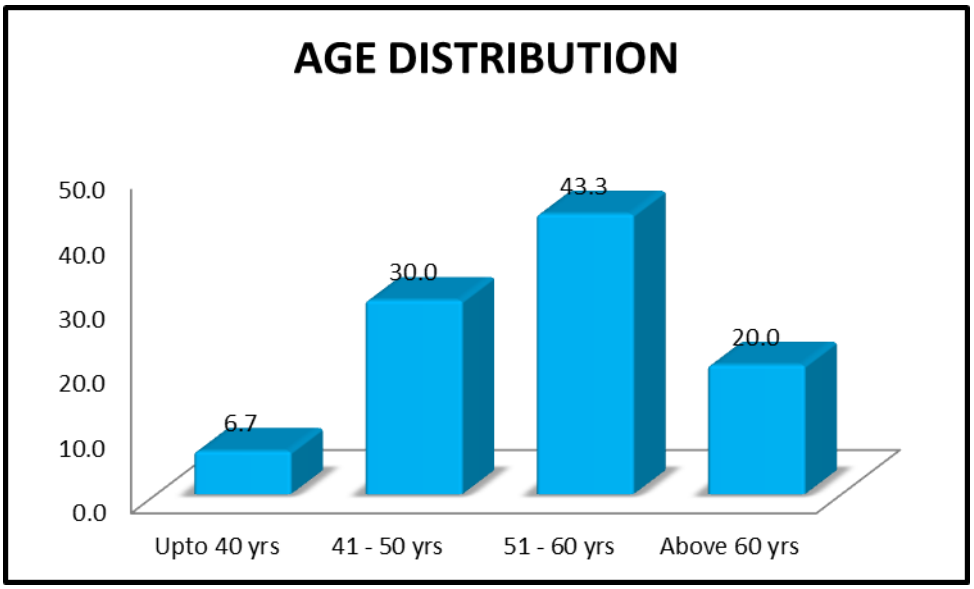
* **Sponsor details -** Not Applicable

* **Compensation -** Not Applicable

* **Insurance -** Not Applicable

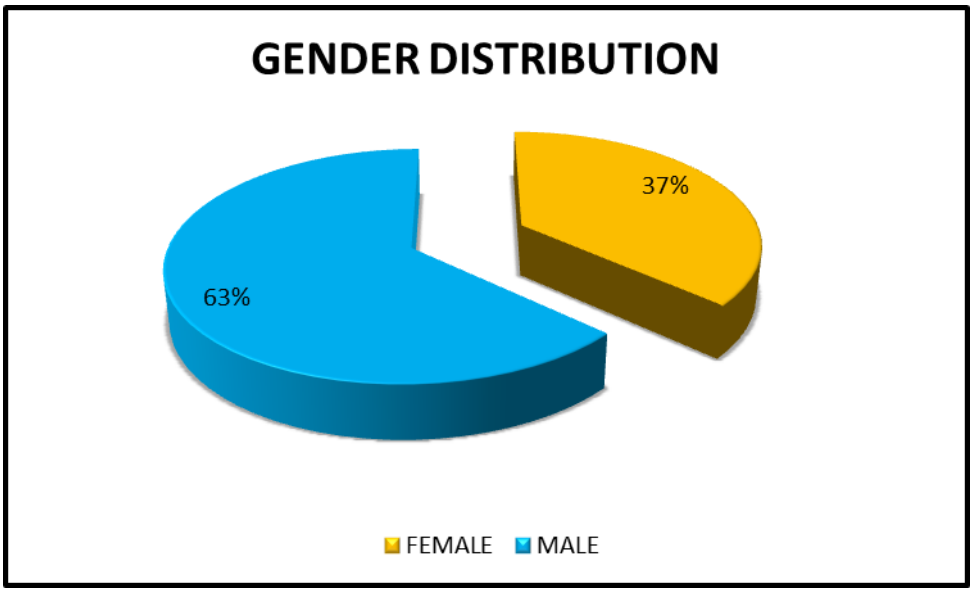
RESULTS AND STATISTICAL ANALYSIS

AGE DISTRIBUTION



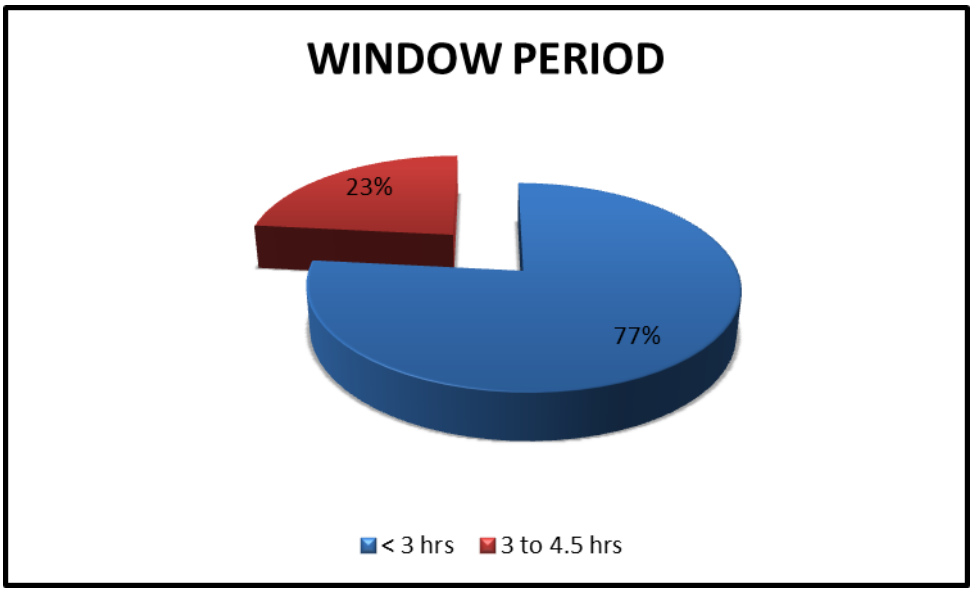
- Among the sample studied the maximum age group falls in the range of 51-60yrs of age with 43.3% of study population in this group.
- Least common group is the age group under 40 yrs comprising 6.7% of the study population.
- The mean age of presentation is 54.77.
- Standard deviation is 8.869.

GENDER DISTRIBUTION



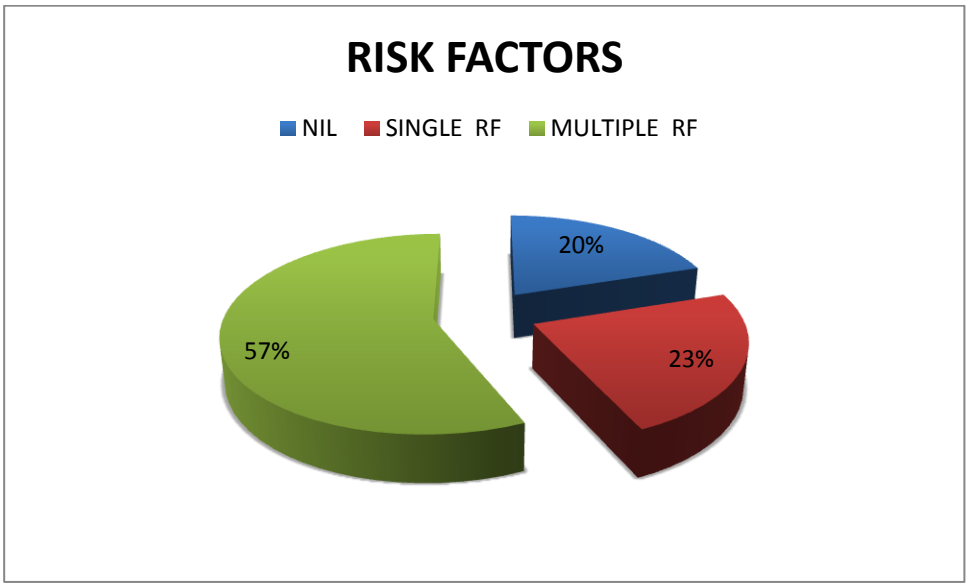
- Among the study population male patients were 63% .
- Female patients were 37%.

TIME OF PRESENTATION (WINDOW PERIOD)



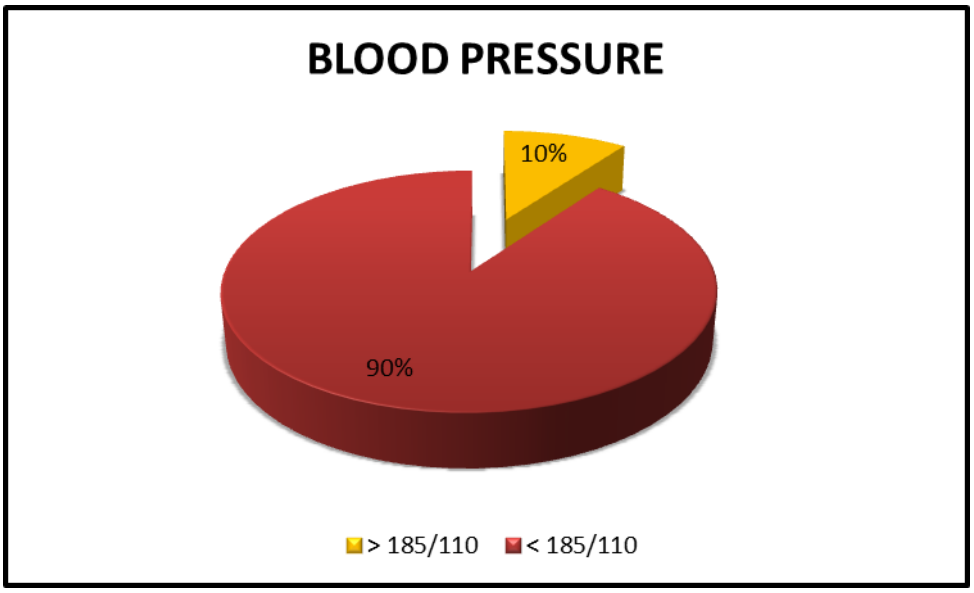
- The patients selected are those who presented within 4.5 hrs from the time of onset of symptoms
- Among them 77% presentated within 3 hours.
- Remaining 23% presented in the extented window period of 3-4.5 hours.
- There is no significant differences in primary outcome in patients presented in 3-4.5 hrs.

DISTRIBUTION OF RISK FACTORS



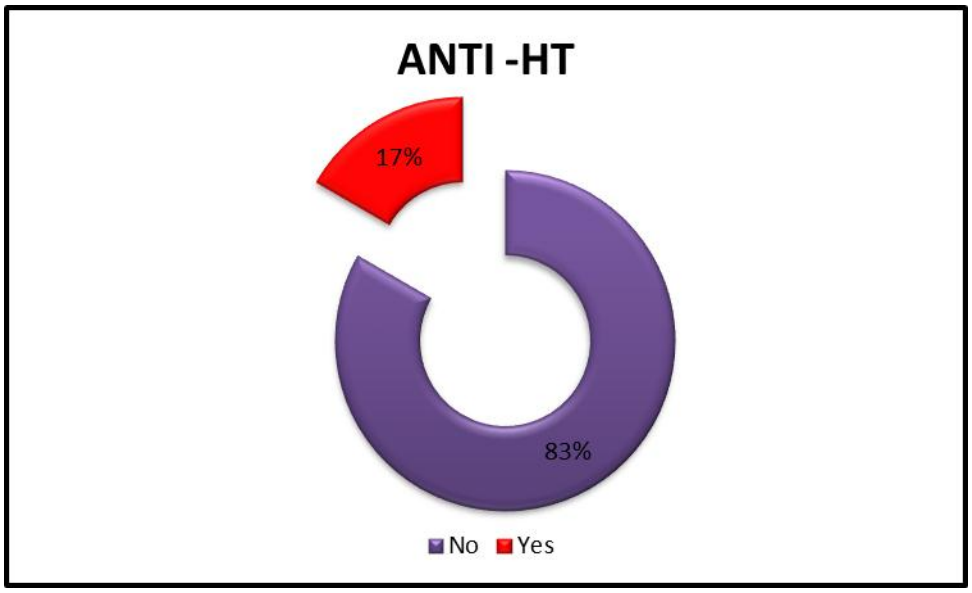
- The study population who had multiple risk factors are 57%.
- 23% had a single risk factor.
- 20% had no asociated risk factors.

BLOOD PRESSURE AT THE TIME OF ADMISSION



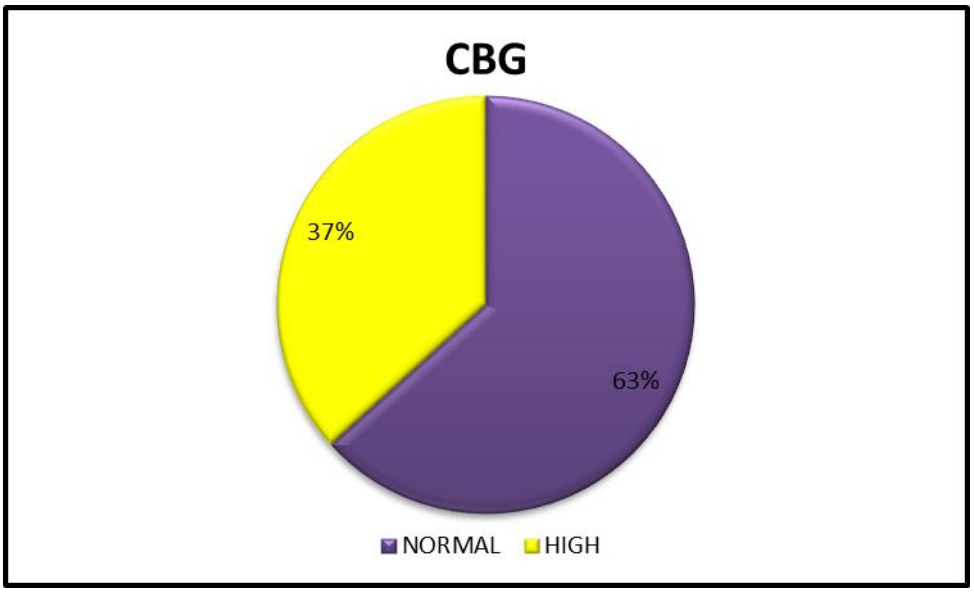
- Among the sample population 90% of the patients presented in the range of BP <185/110 mmHg.
- 10% of them had high BP more than 185/110mmHg.
- The mean systolic BP at presentation is 155 mmHg with standard deviation of 22.689
- The mean diastolic BP at presentation is 91mmHg with standard deviation of 10.289

NEED FOR ANTI HYPERTENSIVE



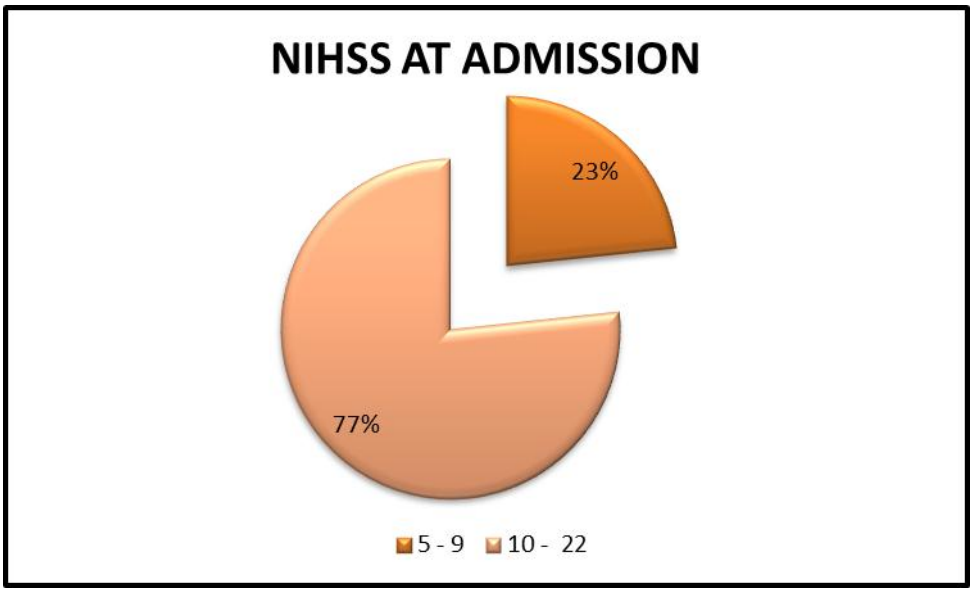
- 83% of the study population does not need an IV anti-hypertensive for control of blood pressure.
- 17% of them needed to be treated with IV anti-hypertensive, that is IV labetelol was given to reduce the BP before thrombolysis.

CAPILLARY BLOOD GLUCOSE AT THE TIME OF ADMISSION



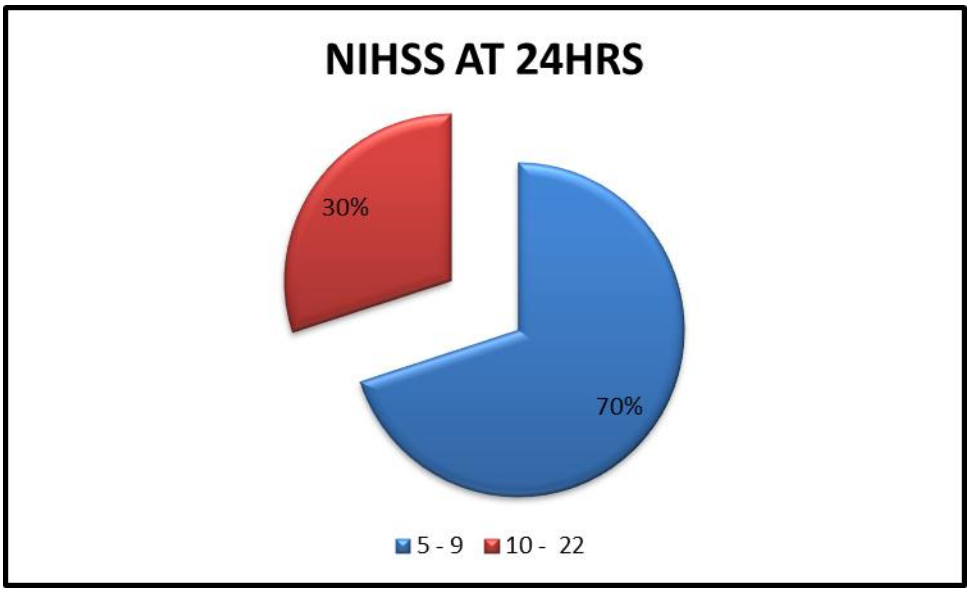
- 37% of the patients were having a high blood glucose level(>200mg/dl) at the time of admission and needed immediate measures to reduce the blood pressure.
- 63% had normal CBG at the time of presentation.
- The mean capillary blood glucose at presentation is 166 mg/dl
- The standard deviation is 54.425.

NIHSS AT THE TIME OF ADMISSION



- The NIHSS score at the time of admission in the range of 5-9 is 23%
- The NIHSS at admission in the range of 10-22 is about 77%.
- The mean score at presentation is 12.60
- Standard deviation is 4.174.

NIHSS AFTER 24 HOURS OF ADMISSION



- After 24 hrs of admission the NIHSS score in the range of 5-9 is 70%
- The score in the range of 10-22 is 30%
- The mean score is 7.83
- The standard deviation is 5.299

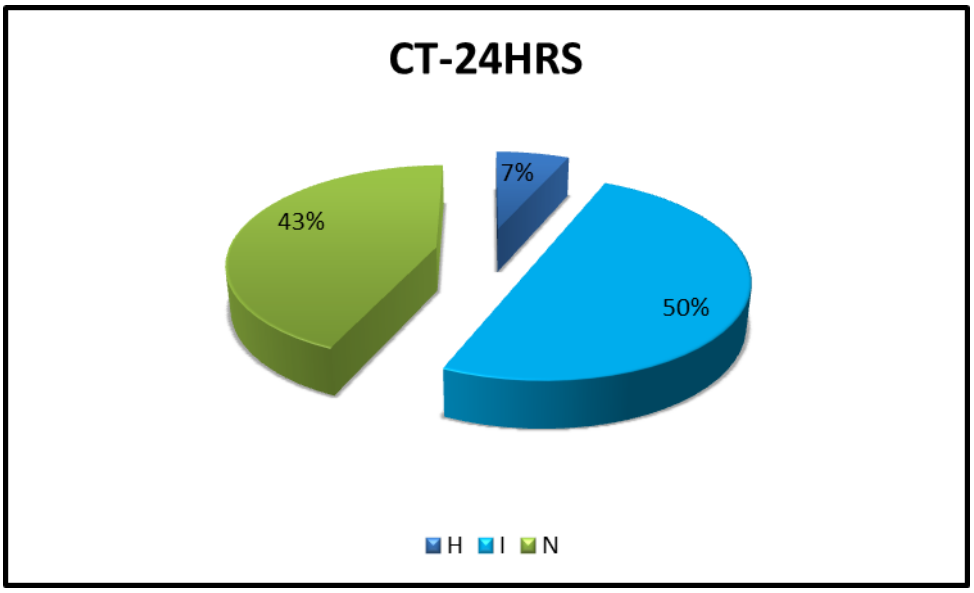
CT SCAN TAKEN AT ADMISSION

- 16.7% presented with early CT changes.
- 83.3% presented with normal CT at the time of admission

ASPECT SCORE

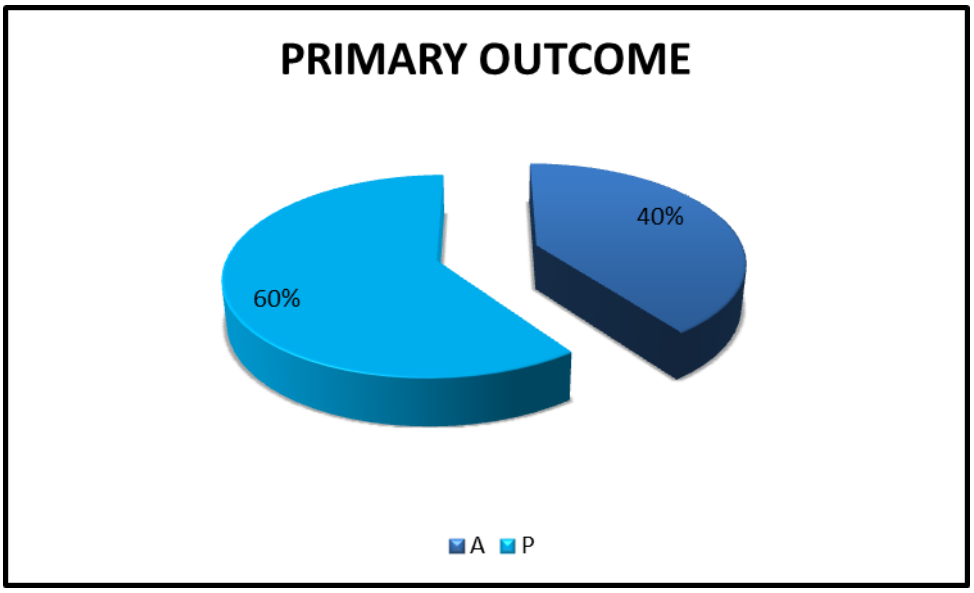
- The maximum score is 10
- The minimum score presented is 7
- The mean ASPECT SCORE is 9.60
- The standard deviation is 0.932.

CT AFTER 24 HOURS



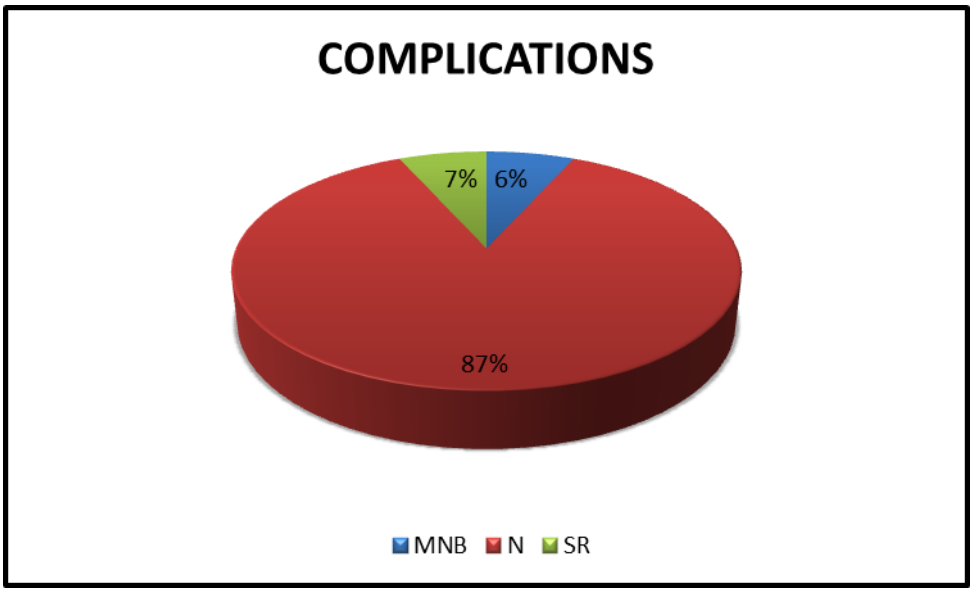
- 50% the study population had ischemic changes in the CT taken after 24 hrs
- 43% had no significant change in CT that is the CT was normal.
- 7% had hemorrhage in the CT taken after 24 hrs.

PRIMARY OUTCOME: (REDUCTION IN NIHSS SCORE BY 4)



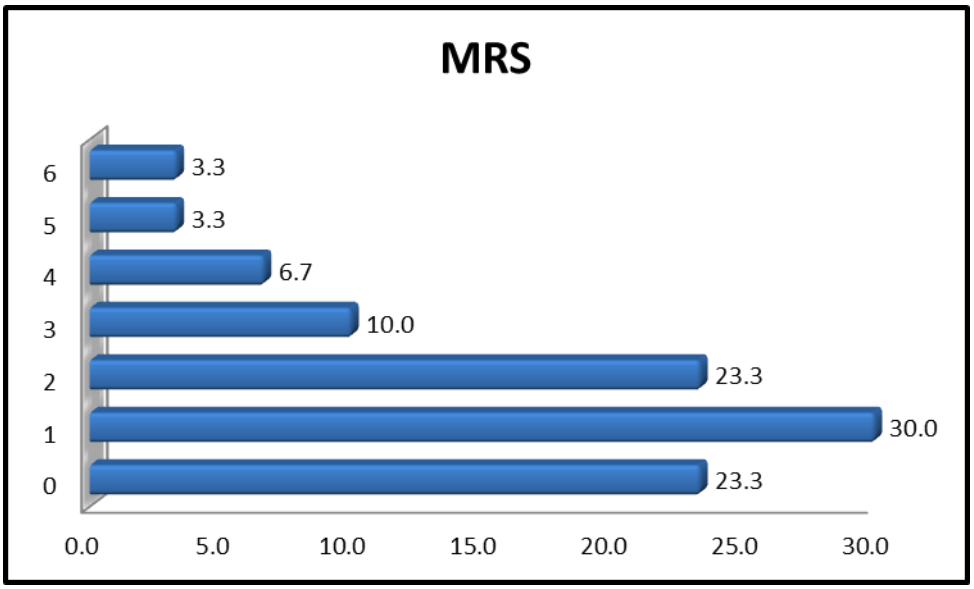
- The primary outcome (i.e) reduction of NIHSS by 4 points from the initial score is present in 60% of the study population.
- Primary outcome is absent in 40% of the study population.

COMPLICATIONS



- 87% had no complication after the therapy.
- 6% had minor bleeding manifestations.
- 7% had skin rashes.
- No one had major bleeding manifestations.

MODIFIED RANKIN SCORE



- The 23.3% of study populaton had a score of 0.
- 30% had a score of 1.
- 23.3% had a score of 2
- So the percentage of study population who had a score of 0-2 is 76.6%
- 23 % had scores more than 2
- The mean score is 1.70
- The standard deviation is 1.557

DISCUSSION

The age group of presentation was analysed. The most common range of age of presentation was 51-60 years. And the least presenting group was age <40 years. Thus the prevalance is maximum in theage group of51-60 years which is benefited by the thrombolytic therapy used for acute ischemic stroke.

The study done by Boehme AK, Siegler JE, Mullen MT, Albright KC, Lyerly MJ, Monlezun DJ, et al. shows the gender distribution as predominant in males. In our study also showed male predominance in the patients undergoing thrombolysis. Male comprises of 63% of patients undergoing thrombolysis.

According to ASA/AHA guidelines the window period for presentation of stroke patients is extended from 3hrs to 4.5 hrs. The patients in the group of time window 3-4.5 hrs also had positive primary outcome. There is no significant differences in primary outcome in patients presenting in<3 hrs and in the extended window period of 3-4.5 hrs.

Kim BJ, Park JM, Kang K, Lee SJ, Ko Y, Kim JG, et al. studied the prevalence of risk factors stated that the presence of multiple risk factors is more common in patients suffering from acute ischemic stroke. About 57% of the study population had multiple risk factors like hypertension, diabetes, dyslipidemia, smoking, alcoholism and cardiac illness. 23% had single risk factor the most common being hypertension. 20% of the study population had no

pre-existing risk factors. This signifies that even in the absence of significant risk factors, acute ischemic stroke can occur.

90% of the study population presented with a BP <185/110 mmHg and 10% with BP >185/110. The mean SBP is155mmHg and mean DBP is 91mmHg which correlates well with the study done by Qureshi AI, Ezzeddine MA, Nasar A et al.

The need for IV anti hypertensive drugs before the administration of alteplase is about 17% which correlates with the data providedby the study of Rodríguez-García JL et al in which the need for anti-hypertensives is studied to be 18%.

Bruno A et al stated that the mean blood glucose at the time of presentation is about 170mg/dl and about 40% of the patients had high blood sugar levels at the time of presentation. In our study the mean blood sugar level is 166 mg/dl and 37% of patients needed correction of blood glucose levels before thrombolysis

Jagni SP et al in his study had maximum number of cases with NIHSS at the time of admision in the range of 10-22 (80%) and the mean NIHSS at admission was 13.5. In our study 77% of them are in the range of score 10-22,with mean NIHSS was 12.60 and standard deviation is 4.174. This value closely correlates with above study hence statisticaly significant.

The NIHSS after 24 hours in the range of 5-9 was about 70% and score of 10-22 is 30%. The mean value is 7.38 with standard deviation 5.29. There is significant reduction in the score and the shift to the range from 10-22 to 5-9. There is a significant reduction in mean score at admission from 12.60 to 5.29. The difference is 7.31.

Of the CT brain taken at the time of admission 87.3% were normal. 16.7% had early CT changes. The ASPECT score of those with early CT changes were maximum of 10 and minimum of 7. The mean score is 9.60 with standard deviation of 0.9. This data correlates well with the study done by Pexman JH, Barber PA et al

The CT brain taken after 24 hours had ishemic changes in about 50% of cases and 7% had hemorrhagic changes. 43% showed no significant changes. This correlates closely with the data by study of Latchaw RE et al which had 56 % of ischemic changes and 6 % had hemorragic changes.

The primary outcome of the study is the reduction of NIHSS by ≥4 by 24 hours from the time of admission. Jagni et al showed that 57.7% showed significant reduction of NIHSS by 4. Our study showed 60% of cases with positive primary outcome which closely correlates with the above study which is statisticaly significant.

The complications after the thrombolysis are mostly nil (87%). Only a small proportion suffered minor bleeding manifestations(7%) and skin

manifestations by(6%). This correlates with the data from the study by Sandercock et al in which the occurrence of hemorrhage is 7.7%. There were no patients in our study who had life threatening major bleeding manifestations or other major complications.

Modified Rankin Score is done to assess the disability and physical quality of life at the end of 3 months. The score of 0-2 is considered as the good outcome which provides independent life to the patients suffering. The better the mRS score the quality of life after stroke will be better. The full outcome of therapy is the significant reduction in mRS score at the end of 3 months which is considered as secondary outcome of this study. The over all score of mRS in the range of 0-2 in our study is 76.6%. This correlates well with the data by Jagni et al who stated that 76.9% had favourable outcome at the end of 3 months. This value is statisticaly significant and many studies show similar outcome.

INFERENCE

This study gives a statisticaly significant result as the primary outcome being positive. There is substantial and desirable decrease in NIHSS score 4 in about 60% and 77% showed improvement in their quality of life at the end of 3 months. This signifies that the use of intravenous thrombolysis in patients presenting with acute ischemic stroke within the window period of 4.5 hours is beneficial for the patient, and there is a great improvement in quality of life which is assessed after 3 months. Complications of this therapy are also limited and occurrence of major life threatening complications like intracranial bleed is

very less. As per the recent 2018 ASA/AHA guidelines the patients are to be carefully selected and prompt treatment with intravenous thrombolysis is of great use to the patient in preventing permanent disability affecting the quality of life of the patient in the forthcoming years. This ultimately reduce the burden of the society in the form of rehablitation of lives of people and helps them to lead an independent and dignified life.

CONCLUSIONS

- The most common age group affected is 51-60 yrs with 43.3% and least affected age group is <40rs with 6.7%.
- Males are predominantly affected 63%.
- 77% of them presented within the window period of <3hrs and 23%in 3-4.5 hrs.
- Presence of multiple risk factors contribute to occurence of acute ischemic stroke (57%).
- 10% of patients presented with high BP of >185/110mmHg at the time of admission
- 17% of them needed IV anti-hypertensive drugs to reduce the initial BP
- 37% of the study population had high blood sugar at the time of admission.
- The mean blood sugar value at admission is 166mg/dl.
- The mean NIHSS at the time of admission is 12.60
- The mean NIHSS after 24 hours is 7.83
- About 83% had a normal CT and 17% early CT changes at the time of admission

- The mean ASPECT SCORE is 9.60
- 50% had ischemic changes and 7% had hemorrhagic manifestations in CT taken 24 hours later.
- Primary outcome(reduction in NIHSS by 4 points) was present in 60%.
- 87% had no significant complications, only 6 % had minor bleeding manifestations and 7% had skin manifestations.
- The secondary outcome(i.e) mRS of 0-2 at the end of 3 months 76% .

ABBREVATIONS

AIS	-	Acute Ischemic Stroke
aPTT	-	Activated Partial Thromboplastin Time
ASPECTS	-	Alberta Stroke Programme Early CT score
ASRH	-	Acute Stroke Ready Hospital
BP	-	Blood Pressure
CBC	-	Complete Blood Count
CMB	-	Cerebral Micro Bleeds
CNS	-	Central Nervous System
CSC	-	Comprehensive Stroke Center
CT	-	Computed Tomography
DVT	-	Deep Vein Thrombosis
ECG	-	Electrocardiogram
ECT	-	Ecrine Clotting Time
ESRD	-	End Stage Renal Disease
FAST	-	Face,Arm,Speeh,Time
HD	-	Hemodialysis
HMCA	-	Hyperdense Middle Cerebral Artery

ICU	-	Intensive Care Unit
INR	-	International Normalised Ratio
IV	-	Intravenous
LMWH	-	Low Molecular Weight Heparin
MCA	-	Middle Cerebral Artery
MI	-	Myocardial Infarction
MRA	-	Magnetic Resonance angiography
MRI	-	Magnetic Resonance Imaging
MRS	-	Modified Rankin Score
MTICI	-	Modified Treatment in Cerebral Ischemia
NCCT	-	Non Contrast Computed Tomography
NIHSS	-	National Institute of Health Stroke Scale
PSC	-	Primary Stroke Center
PT	-	Prothrombin Time
rt-PA	-	Recombinant Tissue Plasminogen Activator
sICH	-	Symptomatic Intracranial Hemorrhage
TT	-	thrombin time

BIBLIOGRAPHY

1. Martin, Andrew J. (2005-07-27). "Academy Papyrus to be Exhibited at the Metropolitan Museum of Art" (Press release). The New York Academy of Medicine. Archived from the original on November 27, 2010. Retrieved 2015-06-03

2. Allen, James P. (2005). The Art of Medicine in Ancient Egypt. New York/New Haven: The Metropolitan Museum of Art/Yale University Press. ISBN 978-0-300-10728-9. LCCN 2005016908

3. Gomez C. Time is brain. 1993; 3: 1–2.CrossrefMedlineGoogle Scholar

4. Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001. The Blood Supply of the Brain and Spinal Cord. https://www.ncbi.nlm.nih.gov/books/NBK11042/

5. NIH Stroke Scale Training, Part 2. Basic Instruction. Department of Health and Human Services, National Institute of Neurological Disorders and Stroke. The National Institute of Neurological Disorders and Stroke (NINDS) Version 2.

6. Adams HP Jr, Davis PH, Leira EC, Chang KC, Bendixen BH, Clarke WR, Woolson RF, Hansen MD. Baseline NIH Stroke Scale score strongly

predicts outcome after stroke: a report of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). Neurology. 1999;53:126–131

7. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, Khatri P, McMullan PW Jr, Qureshi AI, Rosenfield K, Scott PA,Summers DR, Wang DZ, Wintermark M, Yonas H; on behalf of the American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44:870–947. doi: 10.1161/STR.0b013e318284056a.

8. EE, Kent DM, Bulsara KR, Leung LY, Lichtman JH, Reeves MJ, Towfighi, Whiteley WN, Zahuranec D. Accuracy of prediction instruments for diagnosing large vessel occlusion in individuals with suspected stroke: a systematic review for the 2018 guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2018;49:XXX–XXX. doi: 10.1161/STR.0000000000000160.

9. Berglund A, Svensson L, Wahlgren N, von Euler M; HASTA Collaborators. Face Arm Speech Time Test use in the prehospital setting,

better in the ambulance than in the emergency medical communication center. Cerebrovasc Dis. 2014;37:212–216. doi: 10.1159/000358116.

10. Smith National Institute of Health, National Institute of Neurological DisordersandStroke. https://www.ninds.nih.gov/sites/default/files/NIH_Stroke_Scale_Booklet.pdf

11. Lima FO, Silva GS, Furie KL, Frankel MR, Lev MH, Camargo ÉC, Haussen DC, Singhal AB, Koroshetz WJ, Smith WS, Nogueira RG.Field assessment stroke triage for emergency destination: a simple and accurate prehospital scale to detect large vessel occlusion strokes. Stroke. 2016;47:1997–2002. doi: 10.1161/STROKEAHA.116.013301.

12. Phabphal K, Hirunpatch S. The effectiveness of low-cost teleconsultation for emergency head computer tomography in patients with suspected stroke. Telemed Telecare. 2008;14:439–442. doi: 10.1258/ jtt.2008.080603.

13. Mitchell JR, Sharma P, Modi J, Simpson M, Thomas M, Hill MD, Goyal M.A smartphone client-server teleradiology system for primary diagnosis of acute stroke. J Med Internet Res. 2011;13:e31. doi: 10.2196/ jmir.1732

14. Generalized efficacy of t-PA for acute stroke: subgroup analysis of the NINDS t-PA Stroke Trial. Stroke. 1997;28:2119–2225.

15. Frankel MR, Morgenstern LB, Kwiatkowski T, Lu M, Tilley BC,Broderick JP, Libman R, Levine SR, Brott T. Predicting prognosis

after stroke: a placebo group analysis from the National Institute of Neurological Disorders and Stroke rt-PA Stroke Trial. Neurology. 2000;55:952–959.

16. Lyden P, Brott T, Tilley B, Welch KM, Mascha EJ, Levine S, Haley EC, Grotta J, Marler J. Improved reliability of the NIH Stroke Scale using video training.NINDS TPA Stroke Study Group. Stroke. 1994;25:2220–2226.

17. Josephson SA, Hills NK, Johnston SC. NIH Stroke Scale reliability in ratings from a large sample of clinicians. Cerebrovasc Dis. 2006;22:389–395. Doi10.1159/000094857.

18. Lyden P, Raman R, Liu L, Emr M, Warren M, Marler J. National Institutes of Health Stroke Scale certification is reliable across multiple venues. Stroke. 2009;40:2507–2511. doi: 10.1161/STROKEAHA.108.532069.

19. Chalela JA, Kidwell CS, Nentwich LM, Luby M, Butman JA, Demchuk AM, Hill MD, Patronas N, Latour L, Warach S. Magnetic resonance imaging and computed tomography in emergency assessment of patients with suspected acute stroke: a prospective comparison. Lancet. 2007;369:293–298. doi: 10.1016/S0140-6736(07)60151-2.

20. Barber PA, Hill MD, Eliasziw M, Demchuk AM, Pexman JH, Hudon ME, Tomanek A, Frayne R, Buchan AM; ASPECTS Study Group.

Imaging of the brain in acute ischaemic stroke: comparison of computed tomography and magnetic resonance diffusion-weighted imaging. J Neurol Neurosurg Psychiatry. 2005;76:1528–1533. doi: 10.1136/ jnnp.2004.059261.

21. Latchaw RE, Alberts MJ, Lev MH, Connors JJ, Harbaugh RE, Higashida RT, Hobson R, Kidwell CS, Koroshetz WJ, Mathews V,Villablanca P, Warach S, Walters B; American Heart Association Council on Cardiovascular Radiology and Intervention, Stroke Council, and the Interdisciplinary Council on Peripheral Vascular Disease. Recommendations for imaging of acute ischemic stroke:a scientific statement from the American Heart Association. Stroke.2009;40:3646 3678.

22. Moulin T, Cattin F, Crépin-Leblond T, Tatu L, Chavot D, Piotin M, VieJF, Rumbach L, Bonneville JF. Early CT signs in acute middle cerebral artery infarction: predictive value for subsequent infarct locations and outcome. Neurology. 1996;47:366–375.

23. Flacke S, Urbach H, Keller E, Träber F, Hartmann A, Textor J, Gieseke J,Block W, Folkers PJ, Schild HH. Middle cerebral artery (MCA) susceptibility sign at susceptibility-based perfusion MR imaging: clinical importance and comparison with hyperdense MCA sign at CT. Radiology. 2000;215:476–482.

24. Barber PA, Demchuk AM, Hudon ME, Pexman JH, Hill MD, Buchan AM. Hyperdense sylvian fissure MCA “dot” sign: a CT marker of acute ischemia. Stroke. 2001;32:84–88.

25. Pexman JH, Barber PA, Hill MD, Sevick RJ, Demchuk AM, Hudon ME, Hu WY,Buchan AM. Use of the Alberta Stroke Program Early CT Score (ASPECTS) for assessing CT scans in patients with acute stroke. AJNR Am J Neuroradiol. 2001;22:1534–1542.

26. Barber PA, Darby DG, Desmond PM, Gerraty RP, Yang Q, Li T, Jolley D, Donnan GA, Tress BM, Davis SM. Identification of major ischemic change: diffusion-weighted imaging versus computed tomography.Stroke. 1999;30:2059–2065.

27. Fiebach JB, Schellinger PD, Jansen O, Meyer M, Wilde P, Bender J,Schramm P, Jüttler E, Oehler J, Hartmann M, Hähnel S, Knauth M, Hacke W, Sartor K. CT and diffusion-weighted MR imaging in randomized order: diffusion-weighted imaging results in higher accuracy and lower interrater variability in the diagnosis of hyperacute ischemic stroke. Stroke. 2002;33:2206–2210.

28. Warach S, Chien D, Li W, Ronthal M, Edelman RR. Fast magnetic resonance diffusion-weighted imaging of acute human stroke. Neurology. 1992;42:1717–1723.

29. Albers GW, Lansberg MG, Norbash AM, Tong DC, O'Brien MW, Woolfenden AR, Marks MP,Moseley ME. Yield of diffusion-weighted MRI for detection of potentially relevant findings in stroke patients. Neurology. 2000;54:1562–1567.

30. Sims JR, Rordorf G, Smith EE, Koroshetz WJ, Lev MH, Buonanno F, Schwamm LH. Arterial occlusion revealed by CT angiography predicts NIH stroke score and acute outcomes after IV tPA treatment. AJNR Am J Neuroradiol. 2005;26:246251.

31. Coutts SB, Lev MH, Eliasziw M, Roccatagliata L, Hill MD, Schwamm LH, Pexman JH, Koroshetz WJ, Hudon ME, Buchan AM, Gonzalez RG, DemchukAM. ASPECTS on CTA source images versus unenhanced CT: added value in predicting final infarct extent and clinical outcome. Stroke. 2004;35:2472–2476.

32. Rowat AM, Wardlaw JM, Dennis MS, Warlow CP. Patient positioning influences oxygen saturation in the acute phase of stroke. Cerebrovasc Dis. 2001;12:66–72.

33. Wojner-Alexander AW, Garami Z, Chernyshev OY, Alexandrov AV. Heads down: flat positioning improves blood flow velocity in acute ischemic stroke. Neurology. 2005;64:1354–1357.

34. Schwarz S, Georgiadis D, Aschoff A, Schwab S. Effects of body position on intracranial pressure and cerebral perfusion in patients with large hemispheric stroke. Stroke. 2002;33:497–501.

35. Kasner SE, Wein T, Piriyawat P, Villar-Cordova CE, Chalela JA, Krieger DW, Morgenstern LB, Kimmel SE, Grotta JC. Acetaminophen for altering body temperature in acute stroke: a randomized clinical trial. Stroke. 2002;33:130–134.

36. Prasad K, Krishnan PR. Fever is associated with doubling of odds of short-term mortality in ischemic stroke: an updated meta-analysis. Acta Neurol Scand. 2010 ;122:404–408.

37. Wang Y, Lim LL, Levi C, Heller RF, Fisher J. Influence of admission body temperature on stroke mortality. Stroke. 2000;31:404–409.397. Zaremba J. Hyperthermia in ischemic stroke. Med Sci Monit. 2004;10:RA148-RA153.

38. Qureshi AI, Ezzeddine MA, Nasar A, Suri MF, Kirmani JF, Hussein HM, Divani AA, Reddi AS. Prevalence of elevated blood pressure in 563,704 adult patients with stroke presenting to the ED in the United States. Am JEmerg Med. 2007;25:32–38.

39. Christensen H, Meden P, Overgaard K, Boysen G. The course of blood pressure in acute stroke is related to the severity of the neurological deficits. Acta Neurol Scand. 2002;106:142–147.

40. Potter JF, Robinson TG, Ford GA, Mistri A, James M, Chernova J, Jagger C. Controlling hypertension and hypotension immediately poststroke(CHHIPS) : a randomised, placebo-controlled, double-blind pilot trial. Lancet Neurol.2009;8:48–56.

41. Leonardi-Bee J, Bath PM, Phillips SJ, Sandercock PA; IST Collaborative Group. Blood pressure and clinical outcomes in the International Stroke Trial. Stroke. 2002;33:1315–1320.

42. Okumura K, Ohya Y, Maehara A, Wakugami K, Iseki K, Takishita S. Effects of blood pressure levels on case fatality after acute stroke. JHypertens.2005;23:1217–1223.

43. Vemmos KN, Tsivgoulis G, Spengos K, Zakopoulos N, Synetos A, Manios E, Konstantopoulou P, Mavrikakis M. U-shaped relationship between mortality and admission blood pressure in patients with acute stroke. J Intern Med. 2004;255:257–265.

44. Qureshi AI, Ezzeddine MA, Nasar A, Suri MF, Kirmani JF, Hussein HM, Divani AA, Reddi AS. Prevalence of elevated blood pressure in 563,704 adult patients with stroke presenting to the ED in the United States. Am JEmerg Med. 2007;25:32–38.

45. Ahmed N, Wahlgren N, Brainin M, Castillo J, Ford GA, Kaste M, LeesKR, Toni D; SITS Investigators. Relationship of blood pressure, antihypertensive therapy, and outcome in ischemic stroke treated with

intravenous thrombolysis. retrospective analysis from Safe Implementation of Thrombolysis in Stroke-International Stroke Thrombolysis Register (SITS-ISTR). Stroke. 2009;40:2442–2449

46. Capes SE, Hunt D, Malmberg K, Pathak P, Gerstein HC. Stress hyperglycemia and prognosis of stroke in nondiabetic and diabetic patients: a systematic overview. Stroke. 2001;32:2426–2432.

47. McCormick MT, Muir KW, Gray CS, Walters MR. Management of hyperglycemia in acute stroke: how, when, and for whom? Stroke.2008;39:2177–2185.

48. Bruno A, Levine SR, Frankel MR, Brott TG, Lin Y, Tilley BC, Lyden PD, Broderick JP, Kwiatkowski TG, Fineberg SE; NINDS rt-PA Stroke Study Group. Admission glucose level and clinical outcomes in the NINDrt-PA Stroke Trial. Neurology. 2002;59:669–674.

49. Demchuk AM, Tanne D, Hill MD, Kasner SE, Hanson S, Grond M, Levine SR; mMulticentre tPA Stroke Survey Group. Predictors of good outcome after intravenous tPA for acute ischemic stroke. Neurology. 2001;57:474–480.

50. Pundik S, McWilliams-Dunnigan L, Blackham KL, Kirchner HL,Sundararajan S, Sunshine JL, Tarr RW, Selman WR, Landis DM, Suarez JI. Older age does not increase risk of hemorrhagic complications

after intravenous and/or intra-arterial thrombolysis for acute stroke. J Stroke Cerebrovasc Dis. 2008;17:266–272.

51. Ogata T, Christensen S, Nagakane Y. The Effects of Alteplase 3 to 6 Hours After Stroke in the Epithet–defuse Combined Dataset Post Hoc Case–Control Study Stroke. 2013;44:87-93.

52. Manawadu D, Bodla S, Jarosz J. A Case-Controlled Comparison of Thrombolysis Outcomes between Wake-Up and Known Time of Onset Ischemic Stroke Patients. Stroke. 2013;44:2226-31.

53. Zaki A, Dwedar AZ, Ashour S. Sonothrombolysis in acute middle cerebral artery stroke. Neurol India. 2014;62:62-5.

54. Saposnik G, Guzik AK, Reeves M. Stroke Prognostication using Age and NIH Stroke Scale, SPAN-100, Neurol. 2013;80:21-8.

55. IST-3 collaborative groups, Sandercock P, Wardlaw JM, Lindley RI et al. The benefits and harms of intravenous thrombolysis with recombinant tissue plasminogen activator within 6 h of acute ischemic stroke (the third international stroke trial [IST-3]): a randomised controlled trial. Lancet. 2012;379:2352-63.

56. Diedler J, Ahmed N, Sykora M. Safety of Intravenous Thrombolysis for Acute Ischemic Stroke in Patients Receiving Anti-platelet Therapy at Stroke Onset. Stroke. 2010;41:288-94.

57. Cucchiara B, Tanne D, Levine SR, Demchuk AM, Kasner S. A risk score to predict intracranial hemorrhage after recombinant tissue plasminogen activator for acute ischemic stroke. J Stroke Cerebrovasc Dis. 2008;17:331–333.

58. Thomalla G, Schwark C, Sobesky J. Outcome and Symptomatic Bleeding Complications of Intravenous Thrombolysis within 6 Hours in MRI-Selected Stroke Patients: Comparison of a German Multicenter Study with the Pooled Data of ATLANTIS, ECASS, and NINDS tPA Trials. Stroke. 2006;37:852-8.

59. Yamaguchi T, Mori E, Minematsu K. Alteplase at 0.6 mg/kg for Acute Ischemic Stroke within 3 Hours of Onset Japan Alteplase Clinical Trial (J-ACT). Stroke. 2006;37:1810-5.

60. Schellinger PD, Thomalla G, Fiehler J. MRI-Based and CT-Based Thrombolytic Therapy in Acute Stroke Within and Beyond Established Time Windows : An Analysis of 1210 Patients. Stroke. 2007;38:2640-5.

61. Schellinger PD, Thomalla G, Fiehler J. MRI-Based and CT-Based Thrombolytic Therapy in Acute Stroke Within and Beyond Established Time Windows : An Analysis of 1210 Patients. Stroke. 2007;38:2640-5.

62. Hacke W, Kaste M, Bluhmki E. Thrombolysis with Alteplase 3 to 4.5 Hours after Acute Ischemic Stroke. N Engl J Med. 2008;359:1317-29.

63. Clark WM, Albers GW, Madden KP. The rtPA (Alteplase) 0- to 6-Hour Acute Stroke Trial, Part A (A0276g) Results of a Double-Blind, Placebo-Controlled, Multicenter Study. Stroke. 2000;31:811-6.

64. Tanne D, Gorman MJ, Bates VE. Intravenous Tissue Plasminogen Activator for Acute Ischemic Stroke in Patients Aged 80 Years and Older The tPA Stroke Survey Experience. Stroke. 2000;31:370-5.

65. Hacke W, Albers G, Al-Rawi Y. The Desmoteplase in Acute Ischemic Stroke Trial (DIAS) A Phase II MRI-Based 9-Hour Window Acute Stroke Thrombolysis Trial with Intravenous Desmoteplase Stroke. 2005;36:66-73.

66. Furlan J, Eyding D, Albers GW. Dose Escalation of Desmoteplase for Acute Ischemic Stroke (DEDAS) Evidence of Safety and Efficacy 3 to 9 Hours After Stroke Onset Anthony. Stroke. 2006;37:1227-31.

67. Goldstein JN, Marrero M, Masrur S, Pervez M, Barrocas AM, Abdullah A, Oleinik A, Rosand J, Smith EE, Dzik WH, Schwamm LH. Management of thrombolysis-associated symptomatic intracerebral hemorrhage. Arch Neurol. 2010;67:965–969. doi: 10.1001/archneurol.2010.175

68. Correia AS, Matias G, Calado S, Lourenço A, Viana-Baptista M.Orolingual angiodema associated with alteplase treatment of acute

stroke: a reappraisal. J Stroke Cerebrovasc Dis. 2015;24:doi:10.1016/j.jstrokecerebrovasdis.2014.07.045.

69. O'Carroll CB, Aguilar MI. Management of postthrombolysis hemorrhagic and orolingual angioedema complications. Neurohospitalist.2015;5:133–141. doi: 10.1177/1941874415587680.

70. Lapergue B, Blanc R, Gory B, Labreuche J, Duhamel A, Marnat G,Saleme S, Costalat V, Bracard S, Desal H, Mazighi M, Consoli A, PiotinM; ASTER Trial Investigators. Effect of endovascular contact aspiration vs stent retriever on revascularization in patients with acute ischemic stroke and large vessel occlusion: the ASTER randomized clinical trial. JAMA. 2017;318:443–452. doi: 10.1001/jama.2017.9644

71. The International Stroke Trial (IST): a randomised trial of aspirin, subcutaneous heparin, both, or neither among 19435 patients with acute ischaemic stroke: International Stroke Trial Collaborative Group. Lancet.1997;349:1569–1581.

72. CAST: randomised placebo-controlled trial of early aspirin use in 20,000 patients with acute ischaemic stroke: CAST (Chinese Acute Stroke Trial) Collaborative Group. Lancet. 1997;349:1641–1649.

73. Ginsberg MD, Palesch YY, Hill MD, Martin RH, Moy CS, Barsan WG, Waldman BD, Tamariz D, Ryckborst KJ; ALIAS and Neurological Emergencies Treatment Trials (NETT) Investigators. High-dose albumin

treatment for acute ischaemic stroke (ALIAS) part 2: a randomised, double-blind, phase 3, placebo-controlled trial. Lancet Neurol.2013;12:1049–1058. doi: 10.1016/S1474-4422(13)70223-0.

74. Martin RH, Yeatts SD, Hill MD, Moy CS, Ginsberg MD, PaleschYY; for the ALIAS Parts 1 and 2 and NETT Investigators. ALIAS(Albumin in Acute Ischemic Stroke) trials: analysis of the combined data from parts 1 and 2. Stroke.2016;47:2355–2359. doi: 10.1161/STROKEAHA.116.012825.

75. Lapchak PA. Taking a light approach to treating acute ischemic stroke patients: transcranial near-infrared laser therapy translational science. Ann Med. 2010;42:576–586. doi: 10.3109/07853890.2010.532811.212.

76. Stemer AB, Huisa BN, Zivin JA. The evolution of transcranial laser therapy for acute ischemic stroke, including a pooled analysis of NEST-1 and NEST-2. Curr Cardiol Rep. 2010;12:29–33. doi: 10.1007/ s11886-009-0071-3.

77. Zivin JA, Albers GW, Bornstein N, Chippendale T, Dahlof B, Devlin T,Fisher M, Hacke W, Holt W, Ilic S, Kasner S, Lew R, Nash M, Perez J, Rymer M, Schellinger P, Schneider D, Schwab S, Veltkamp R, WalkerM, Streeter J; for the NeuroThera Effectiveness and Safety Trial-2Investigators. Effectiveness and safety of transcranial laser therapy for

acute ischemic stroke. Stroke. 2009;40:1359–1364. doi: 10.1161/STROKEAHA.109.547547.

78. Hacke W, Schelinger PD, Albers GW, Bornstein NM, Dahlof BS, KasnerSE, Howard G, Shuaib A, Richieri SP, Dilly S, Zivin J. Transcranial laser therapy (TLT) for acute ischemic stroke: results of NEST 3, a pivotal phase III randomized clinical trial (RCT). Cerebrovasc Dis.2013;35:191.

79. Frankel MR, Morgenstern LB, Kwiatkowski T, et al. Predicting prognosis after stroke: a placebo group analysis from the National Institute of Neurological Disorders and Stroke rt-PA Stroke Trial. Neurology 2000; **55:** 952–59.

80. Shinohara Y, Minematsu K, Amano T, Ohashi Y. Modifi ed Rankinscale with expanded guidance scheme and interview questionnaire:interrater agreement and reproducibility of assessment. Cerebrovasc Dis 2006; **21:** 271–78.

A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL

PROFORMA

NAME : AGE: SEX:

ADDRESS: CONTACT NO:

COMPLAINTS:

HISTORY

TIME SINCE ONSET OF WEAKNESS

ASSOCIATED FEATURES AT THE TIME OF ONSET

SEIZURES

HEADACHE

TRAUMA

HISTROY OF CO-MORBID ILLNESS AND PAST HISTROY

- T2DM:
- SHT:
- CAD / MI IN LAST 3 MONTHS
- STROKE / TIA / ICH IN 3 MONTHS
- RECENT MAJOR SURGERIES
- RECENT ACTIVE BLEEDING MANIFESTATIONS/ ON ANTICOAGULANTS
- PREGNANCY
- PSYCHIATRIC ILLNESS

PERSONAL HISTROY

- DRUGS/ TOXINS/ SUBSTANCE ABUSE

CLINICAL EXAMINATION:

GENERAL EXAMINATION:

SYSTEMIC EXAMINATION:

CARDIOVASCULAR SYSTEM:

RESPIRATORY SYSTEM:

GASTRO-INTESTINAL SYSTEM :

CENTRAL NERVOUS SYSTEM :

NIHSS SCORE AT THE TIME OF ADMISSION:

INVESTIGATIONS:

ROUTINE INVESTIGATIONS:

CBC: RFT: RBS:

NON CONTRAST CT BRAIN:

AT ADMISSION

AFTER 24 HOURS

MRI BRAIN

TIME OF STARTING TROMBOLYSIS:

ASSESSMENT OF PATIENT WITH NIHSS SCORE AFTER 24 HOURS

COMPLICATIONS :

COMPLICATIONS	YES	NO
ALLERGIC REACTIONS		
MINOR BLEEDING MANIFESTATIONS		
MAJOR BLEEDING MANIFESTATIONS		
OTHERS		
DEATH		

ASSESSMENT USING MODIFIED RANKIN SCORE AFTER 3 MONTHS:

CLINICAL OUTCOME	**SCORE**
No symptoms	0
No significant disabilities, despite symptoms, able to perform all usual duties and activities	1
Slight disability,unable to perform all previous activities, but able to look afterown affairs without assistance	2
Moderate disability,requires some help,but able to walk without assistance	3
Moderately severe disability,unable to walk without assistance and unable to attend own bodily needs without assistance	4
Severe disability,bedridden,incontinent and requires constant nursingcare and attention	5
Death	6

PATIENT INFORMATION SHEET

A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL

I ,Dr.M.Yamini, post graduate Deparment of General Medicine ,Government Stanley Medical College is going to undertake the study on the above mentioned topic

The purpose of this study is to assess the clinical outcome of patients undergoing stroke thrombolysis in our department

If you are willing to participate in this study you will be asked some questions regarding your preference of health facilities during illness and its reasons and questions regarding financial dependency, self reported chronic illness, satisfaction with health services etc.,

Though you may not benefit directly from the study, it is possible that the findings of the study based on your response may be of great help in planning strategies for protecting you and other people in future.

I assure that all the information provided by you will be kept highly confidential and privacy is assured. Your identity won't be revealed to anyone. The study may be published in scientific journal, but your identity will not be revealed.

Your participation in this study is voluntary and you can withdraw from this at any point of time

Signature/ left thumb impression of the participant

INFORMED CONSENT

A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL

The content of the information sheet dated _____ that was provided have been read carefully by me/explained in detail to me, in a language that I comprehend and fully understood the contents.

I confirm that I have had the opportunity to ask questions.

The nature and purpose of the study and its potential risks/benefits and expected duration of the study and other relevant details of the study have been explained to me in detail.

I understand that my participant is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal right being affected.

I agree to take part in the above study

_____

(Signature/Left thumb impression)

Name of the Participant: _____

Son/Daughter/Spouse of _____

Complete postal address: _____

This is to certify that the above consent has been obtained in my presence.

_____

Date:

Signature of the principal investigator

Place:

1) Witness – 1

Signature:

Name:

Address:

2) Witness – 2

Signature:

Name:

Address

GOVT. STANLEY MEDICAL COLLEGE, CHENNAI – 600001

INFORMED CONSENT

A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL

Place of study: Govt. Stanley medical college, Chennai

I ……. have been informed about the details of the study in my own language.I have completely understood the details of the study. I am aware of the possible risks and benefits, while taking part in the study.I agree to collect samples of blood/saliva/urine/tissue if study needs.I understand that I can withdraw from the study at any point of time and even then, I can receive the medical treatment as usual. I understand that I will not get any money for taking part in the study.

I will not object if the results of this study are getting published in any medical journal, provided my personal identity is not revealed.

I know what I am supposed to do by taking part in this study and I assure that I would extend my full cooperation for this study.

Volunteer:	Witness:
Name and address	Name and address
Signature/thumb impression:	Signature/thumb impression
Date:	Date:

Investigator Signature and date

GOVT. STANLEY MEDICAL COLLEGE, CHENNAI – 600001

INFORMED CONSENT

A STUDY OF CLINICAL PROFILE OF PATIENTS UNDERGOING STROKE THROMBOLYSIS IN A TERTIARY CARE HOSPITAL

நான் இந்த ஆராய்ச்சியில் விவரங்களை முற்றிலும் புரிந்து கொண்டேன். ஆய்வில் பங்கு எடுத்து போது, சாத்தியமான அபாயங்கள் மற்றும் பயன்களை பற்றி நான் அறிந்துள்ளேன். நான் எந்தவொரு வேளையிலும் ஆய்வில் இருந்து திரும்ப முடியும், அதன் பின்னர், நான் வழக்கம் போல் மருத்துவ சிகிச்சை பெற முடியும் என்று புரிந்துகொள்கிறேன்

நான் ஆய்வில் பங்கு எடுத்து பணம் எதையும் பெற முடியாது என்று அறிந்துள்ளேன். இந்த ஆய்வின் முடிவுகள் எந்த மெடிக்கல் ஜர்னலில் வெளியிடப்பட இருந்தால் நான் எதிர்க்கவில்லை, என் தனிப்பட்ட அடையாளத்தை வெளிப்படுத்தப்பட்டு இருக்க கூடாது.

நான் இந்த ஆய்வில் பங்கெடுப்பதன் மூலம் நான் என்ன செய்ய போகிறேன் என்று தெரியும் நான் இந்த ஆய்வில் என் முழு ஒத்துழைப்பையும் கொடுப்பேன் என்று உறுதியளிக்கிறேன்.

தன்னார்வளர்	சாட்சி
பெயர் மற்றும் முகவரி	பெயர் மற்றும் முகவரி
கையொப்பம் / விரல் ரேகை:	கையொப்பம் / விரல் ரேகை:
ஆராய்ச்சியாளராக	கையொப்பம் மற்றும் தேதி

MASTER CHART

S.NO	AGE	SEX	WINDOW PERIOD	RISK FACTOR	BP	ANTI - HT	NIHSS AT ADM	NIHSS AT 24HRS	CBG	CT - ADM	ASPECT	CT-24HRS	COMPLIC	PRIMARY OUTCOME	MRS
1	42	M	A	H/D/S	150/90	N	12	6	210	N	10	N	N	P	1
2	70	F	A	H/D	160/90	N	10	6	200	N	10	N	N	P	2
3	56	M	A	H	200/100	Y	10	5	110	N	10	I	N	P	2
4	53	M	B	N	200/110	Y	7	6	135	E	8	I	N	A	2
5	50	F	A	D	159/90	N	6	4	233	N	10	I	N	A	1
6	50	M	B	H/S	140/90	N	6	0	126	N	10	N	N	P	0
7	56	M	A	H/S/A	150/90	N	12	15	100	E	7	I	N	A	4
8	38	M	B	S/A	130/80	N	8	4	95	N	10	H	MNB	P	1
9	48	F	A	H/D/C/L	140/90	N	8	0	200	N	10	N	N	P	0
10	65	M	A	H/T	150/90	N	12	0	158	N	10	I	N	P	0
11	41	M	A	S/D/C/A	160/90	N	16	7	203	N	10	I	N	P	1
12	50	F	A	H/D	160/90	N	10	7	202	N	10	I	N	A	1
13	65	M	A	H/S	100/60	N	14	17	137	N	10	I	N	A	6
14	56	F	A	N	190/110	Y	17	4	236	N	10	I	N	P	0
15	37	M	A	S/A	140/80	N	15	10	142	N	10	H	MNB	P	2
16	58	F	A	N	130/80	N	20	18	103	N	10	N	N	A	4
17	60	M	B	D	150/90	N	10	8	215	N	10	I	N	A	0
18	56	M	A	S/A	140/90	N	16	6	99	N	10	N	N	P	0
19	65	M	A	S	190/100	Y	15	7	136	N	10	N	N	P	1
20	60	F	B	D/H	160/90	N	16	15	298	E	7	I	N	A	5
21	58	F	A	H	170/100	N	10	4	155	E	8	I	N	P	2
22	43	M	A	D/H	150/90	N	20	18	236	N	10	N	N	A	3
23	49	M	A	H/F	160/100	N	9	4	170	N	10	N	N	P	1
24	65	F	A	N	150/90	N	8	3	109	N	10	N	N	P	1
25	50	M	B	D	160/80	N	17	15	210	E	8	I	N	A	3
26	70	M	A	H	190/110	Y	20	8	105	N	10	N	N	P	0
27	60	F	B	N	170/90	N	16	13	128	N	10	I	SR	A	3
28	59	M	A	D/A/S	130/80	N	10	6	214	N	10	I	N	P	2
29	58	M	A	N	130/90	N	13	6	111	N	10	N	N	P	1
30	55	F	A	H/D/O	160/100	N	15	13	222	N	10	N	SR	A	2

WINDOW PERIOD

A- <3hrs

B- 3-4.5hrs

RISK FACTOR

H- HYPERTENSION

D- DIABETES MELLITUS

L-DYSLIPIDEMIA

S- SMOKER

A- ALCOHOLIC

C- CARDIAC DISEASE

O-OBESITY

T- H/O TIA

F- FAMILY H/O

N- NIL RISK FACTOR

NEED FOR ANTI HYPERTENSIVE

Y- YES

N- NO

CT-AT ADMISSION

N- NORMAL

E- EARLY CT CHANGES

CT-24HRS

N- NORMAL

I- INFARCT

H- HEMORRAGE

COMPLICATION

N- NIL

MNB- MINOR BLEED

MJB-MAJOR BLEED

SR-SKIN RASH

A- ANAPHYLAXIS

PRIMARY OUTCOME

NIHSS REDUCED BY 4

P- PRESENT

A- ABSENT

MRS-Modified Rankin score

0- NO SYMPTOMS

1- ABLE TO PERFORM ALL DUTIES AND ACTIVITIES

2-SLIGHT DISABILITY

3- MODERATE DISABILITY

4- MODERATELY SEVERE DISABILITY

5-SEVERE DISABILITY

6- DEATH

ASPECT SCORE

10- NORMAL

6-10- EARLY CT CHANGES

<6 - FORMED INFARCT

CBG

<200- NORMAL

> 200- HIGH

BP

>185/110- NEED ANTI-HYPERTENSIVE